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Essays on bank profitability, stability and efficiency: the impact of financial inclusion and bank competition

By

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Statement of Originality

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Abstract

This thesis bundles four empirical studies and focuses on the role of bank competition and financial inclusion on bank performance–profitability, stability and efficiency. The first essay uses bank-level data from an emerging market economy–India– and finds that credit risk (defined as NPL ratio) has negative effects on profitability, and it is more pronounced for foreign-owned banks. However, this dampening effect diminishes as bank size increases. The second essay exploits membership variation of Indian banks of a unique institutional mechanism–Corporate-Debt-Restructuring (CDR)–to test whether banks that have restructured corporate loans and made use of extensive regulatory forbearance on asset classification and provisioning on those loans, improve their stability for the period 1992-2012. We find robust evidence that CDR improves banking stability of the treated banks but this treatment effect decreases as the market power of banks increases.

Together with bank stability, broadening access to finance has become an important public policy priority since the global financial crisis. Therefore, in the final two essays, we first construct a composite index of financial inclusion for 87 countries for the period 2004-2012, and then show robust evidence that an inclusive financial sector is good for bank stability, cost and profit efficiency in a sample of 2,913 banks using different estimation techniques and methodologies. These effects are stronger when banks have higher market power and operate in countries with stronger rule of law and institutional quality.

The results in this thesis are novel in the literature and have important public policy implications. First, Indian policymakers should emphasise further improvement of asset quality and strike the right balance while promoting bank competition along with having a stable banking sector. Second, policymakers around the world should introduce more enabling inclusive financial environment to ensure sound and efficient functioning of banks while achieving financial inclusion as a development goal.

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Abbreviations

AFI	Alliance for Financial Inclusion
ATM	Automated Teller Machine
ATT	Average Treatment Effect for the Treated
BIFR	Board for Industrial and Financial Reconstruction
CDR	Corporate Debt Restructuring
CE	Cost Efficiency
CGAP	Consultative Group to Assist the Poor
CR	Concentration Ratio
CRR	Cash Reserve Ratio
DCA	Debtor-Creditor Agreement
DDD	Difference-in-Difference-in-Differences
DEA	Data Envelopment Analysis
DID	Difference-in-Differences
DRTs	Debt Recovery Tribunals
ES	Efficient Structure
FAS	Financial Access Survey
FII	Financial Inclusion Index
G20	Group of Twenty
GCC	Arab Gulf Cooperation Council
GDP	Gross Domestic Product
GFI	Global Financial Inclusion
GMM	Generalized Method of Moments
GPIFI	G20 Principles for Innovative Financial Inclusion
HAC	Heteroskedasticity and Autocorrelation Consistent
HHI	Herfindahl-Hirschman Index
ICA	Inter-Creditor Agreement
IFC	International Finance Corporation
IMF	International Monetary Fund
IV	Instrumental Variable
LM	Lagrange Multiplier
MP	Market Power

NPL	Non-Performing Loan
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Squares
PCA	Principal Component Analysis
PE	Profit Efficiency
PSM	Propensity Score Matching
RBI	Reserve Bank of India
RMP	Relative Market Power
ROA	Return-on-Assets
ROE	Return-on-Equity
SCP	Structure-Conduct-Performance
SD	Standard Deviation
SFA	Stochastic Frontier Analysis
SLR	Statutory Liquidity Ratio
VIF	Variance Inflation Factor
WBES	World Bank Enterprise Surveys
WDI	World Development Indicator
WPI	Wholesale Price Index

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Chapter I

Introduction

1.1 Background

Financial institutions play critical roles in facilitating development in an economy. They exist to reduce informational asymmetries and transaction costs that hinder channeling an economy's savings towards the most productive investment opportunities (Rajan and Zingales, 1998; Demirgüç-Kunt, Beck and Honohan, 2008). Banks build relationship with customers, and in so doing, they acquire and process proprietary information to reduce information asymmetry frictions–that typically inhibit arm's length arrangements in market transactions because of adverse selection and moral hazards, that are binding with borrowers (Diamond, 1984; Fama, 1985). Evidence suggests that financial development, that is efficient operation of the banking sectors, stimulates economic growth (King and Levine, 1993; Rajan and Zingales, 1998; Beck, Levine and Loayza, 2000). Well-functioning financial institutions–ensuring efficient allocation of funds and providing access to financial services for all households and firms–enhance growth, improve income distribution and reduce poverty. However, when they work inefficiently, growth and entrepreneurial innovation opportunities are reduced, income

inequalities persist, and in the extreme cases costly financial crisis follows such as the crisis of 2007-08 (Demirgüç-Kunt, Beck and Honohan, 2008). As banks invest in risky and illiquid loans by using riskless and liquid demandable deposits (Boot and Thakor, 2015), bankruptcy of banks poses serious systemic risks that would entail growth loses for the real economy. Therefore, unlike non-financial institutions, banks are heavily regulated and supervised for ensuring their efficient functioning in the economy.

In the last two decades, banking sectors around the world, particularly in the developing economies, have gone through numerous important reforms and structural changes. When regulatory barriers fell, *de novo* entry of private domestic and foreign banks increased; with the advancement of technology a new frontier of financial intermediation emerged (e.g., mobile banking, agent banking); opportunities to diversify business towards non-traditional banking activities and new geographic areas opened; and enthusiasm for commercial bank's microfinance style of operations was encouraged. In the last two decades, the Indian banking sector has observed two major financial reforms. The outcome of these reforms is a healthy competitive environment, where banks of heterogeneous sizes (e.g., small and large banks) and ownership types (e.g., public, private domestic and private foreign banks) compete fiercely for market shares. Due to greater competitive pressures, banks not only have opted for selecting high standard borrowers and proper allocation of loans to improve asset quality and thus reduce credit risk but also have increasingly focused on non-interest fee/commission-based banking activities for higher profits. Therefore, the changing milieu of banking operations has substantial effects on bank profitability. Existing literature suggests that the differences in resource, expertise and objectives between different sizes of banks and/or ownership groups to monitor loans may have considerable influences on the lending decisions they make and the ways they conduct their business activities for profits (e.g., Berger, Dick, Goldberg and White, 2007;

Mercieca, Schaeck and Wolfe, 2007; Stever, 2007; Bhaumik and Piesse, 2008; Goddard, McKillop and Wilson, 2008; Lepetit, Nys, Rous and Tarazi, 2008). Furthermore, empirical evidence prior to the recent global financial crisis suggested that government ownership of banks leads to suboptimal performances and fetters financial development (La Porta, Lopez de Silanes and Shleifer, 2002; Khwaja and Mian, 2005). However, more recent evidence suggests that lending by state-owned banks is less procyclical than that of private sector banks, and as such assists in smoothing macroeconomic volatility during crisis periods (Berger, Molyneux and Wilson, 2015; Bertay, Demirgüç-Kunt and Huizinga, 2015).

In addition to the multifaceted financial reforms, the Indian government has been consistently working to establish a sound regulatory framework in order to facilitate effective supervision and institutional infrastructure. To facilitate speedy recovery of defaulted loans without needing the Civil Procedure Code, the Indian authorities ratified *Debt Recovery Tribunals (DRTs)* Act in 1992. In 2002, the *Securitisation and Reconstruction of Financial Assets and Enforcement of Securities Interest (SARFAESI)* Act was enacted to strengthen the rights of the secured creditors, thereby financial institutions were allowed to seize and liquidate the assets of the defaulted firm without much delay. Furthermore, in the early 2000s, to reduce credit risk and enhance financial stability, the Central Bank of India–Reserve Bank of India (RBI) – introduced an out-of-court restructuring programme called *Corporate Debt Restructuring (CDR)*–a speedy, cost effective, and market friendly institutional mechanism, for restructuring corporate debts in order to reduce nonperforming corporate loans, and hence improve banking stability. Banks were extended special regulatory forbearance on asset classification and provisioning to the restructured assets. Although according to the global practice any assets restructured should fall into lower asset category and loan loss provisions should be made

accordingly, as per the *CDR* scheme, any standard assets not only could retain their assets classification upon restructuring without slipping into lower asset categories but also were allowed to make concessional provisions of 2% only. Therefore, this special regulatory forbearance on asset classification and provisioning may have given extra opportunities to the banks who participated in the restructuring loans, thereby understating nonperforming loans and overstating net income.

Despite all the reforms that have taken place over the last two decades in most of the countries around the world, particularly in the developing world, the total adult population yet to be included in the banking systems is staggering. The need for long-term credits by households and enterprises is enormous, especially in the developing countries. Recent studies show that almost 2.5 billion adults, just over half of the world's adult population, do not use any form of formal financial services (that is, only 41% of people in the developing countries compared to 89% in developed ones have bank accounts) (Kendall, Mylenko and Ponce, 2010; Demirgüç-Kunt and Klapper, 2012). The most challenging issues for the financial institutions to facilitate access to finance are the high operating costs and the risk associated with servicing, monitoring and administering loans to individual households and small and medium enterprises (SMEs) who often lack required documentations, collaterals and credit histories (e.g., Conning, 1999; Demirgüç-Kunt, Beck and Honohan, 2008; Hermes, Lensink and Meesters, 2011). Therefore, broadening access of the low income groups to formal financial services has always been perceived as an antagonistic strategy, which might dampen the performance of banks. However, over the last decade, extending access of the low income groups to the formal financial sector has become a public policy priority around the world. The central banks both in emerging and developed countries have taken many initiatives in conjunction with many multilateral agencies including the IMF, G20, the Alliance for Financial Inclusion

(AFI), and the Consultative Group to Assist the Poor (CGAP) to enhance the inclusive banking agenda (Demirgüç-Kunt, Beck and Honohan, 2008).

According to modern development theory, lack of access to finance acts as a critical mechanism for generating persistent income inequality and sluggish growth (Demirgüç-Kunt, Beck and Honohan, 2008; Demirgüç-Kunt and Cihak, 2015). More recent studies show that financial institutions are increasingly searching for new markets and opportunities and focusing on broadening access of the unbanked population to formal financial services as they encounter fierce competition (Beck and Brown, 2014). They also see the benefits of including poor customers in the formal banking systems and adopting microfinance style operations (Harper and Arora, 2005). Both theoretical and empirical literature show that the level of bank competition has implications for a borrower's access to finance, the degree of banking stability, efficient allocation of funds and the resulting efficient banking operations, and hence economic growth (Keeley, 1990; Petersen and Rajan, 1995; Koetter, Kolari and Spierdijk, 2012; Love and Martínez Pería, 2014). In addition, existing literature also shows that greater institutional development facilitates better access to finance especially for the smallest firms (Beck, Demirgüç-Kunt and Maksimovic, 2005); for example, more effective rule of law provides more flexibility in terms of contract enforcement without much delay.

1.2 Research objectives and contributions

Motivated by the background above, the aim of this thesis is to take stock of existing banking literature on bank performance and offer new insight into three distinct banking issues–market structure, bank regulation and financial inclusion. To this end, this study provides new evidence while complementing existing literature in the context of the Indian banking sector–a key emerging economy–on the relationship between bank performance, bank competition and bank risk. Furthermore, considering the overarching

importance of inclusive finance for economic growth, this study also provides novel empirical evidence–most probably the first comprehensive empirical work–on the impact of financial inclusion on stability and efficiency of banks by drawing an international sample of developed and developing economies. It also investigates the role of bank competition and institutional quality on these relationships, and makes some important contributions in the literature which should be useful for policy guidelines as follows:

First, empirical evidence on the issues related to bank profitability, competition and risk is abundant in the context of developed market economies. Such research however in the context of the Indian banking sector is somewhat inadequate and often limited to the analyses of productivity and technical efficiency differentials between ownership groups (see, Das and Ghosh, 2006, 2009; Sahoo and Tone, 2009; Tabak and Tecles, 2010; Das and Kumbhakar, 2012; Bhattacharyya and Pal, 2013; Fujii, Managi and Matousek, 2014; Tzeremes, 2015). Most of these studies have employed either parametric or non-parametric techniques to measure efficiency scores for individual banks and then found the differentials between bank ownership types. So far existing literature fails to consider two important banking issues – nonperforming loans and non-traditional banking activities, and how these issues affect bank performance. More recently a study by Pennathur, Subrahmanyam and Vishwasrao (2012) investigated the impact of income diversification on bank risk disentangling the ownership factor, but the issue of bank size heterogeneity and mixed ownership groups on the impact of credit risk and income diversification is still unexplored. Despite multiple reforms, the Indian banking sector is still dominated by state-owned banks and the sizes of banks are heterogeneous. According to Bhaumik and Piesse (2008), since emerging markets are undergoing substantial reforms, credit disbursal behaviour may vary significantly across banks of different ownership types. Therefore, it is important to delve deep into the role of bank size and ownership structure on the effects of credit risk and income diversification on profitability, while using bank-level data for

the post reform periods, that is, from 2004 to 2011. This chapter complements the existing studies, providing new evidence drawn from one of the fastest-growing emerging economies of the world–India. The findings of this study have substantial policy implications for India as well as for other emerging economies (e.g., Bangladesh) that have undergone similar financial reforms in the last two decades. It contributes to the debate on how heterogeneous bank sizes and ownership structure can moderate the effects of credit risk and income diversification on banking profitability.

In general, the empirical evidence is in line with the results of developed market economies that market concentration increases bank performance, suggesting large banks dominate the entire banking industry. It shows that credit risk has a negative impact on profitability which is pronounced for the foreign-owned banks. The dampening effects of nonperforming loans diminish as bank size increases. As bank size gets bigger, the positive effect of non-interest income increases. These findings–the influence of bank size/ownership on the impact of credit risk or income diversification–can provide an understanding of heterogeneities when formulating policies in order to augment profitability and financial stability in the banking sector. Since a profitable financial system absorbs negative shocks at a macro level, the determinants of profitability can capture unstable economic conditions (Athanasoglou, Brissimis and Delis, 2008; Albertazzi and Gambacorta, 2009), which would also be of interest to bank management, financial markets, and academics.

Second, in the third chapter we build on the first study and delve deep into credit risk. As credit risk is the perennial problem of the Indian banking sector, the government of India has introduced various laws and institutional mechanisms to curb this risk. The notable laws that were enacted in the last two decades were *DRTs* of 1993 and the *SARFAESI* Act of 2002. Both laws have strengthened the legal right of banks to enforce debt contracts. Similarly, in the early 2000s, as Indian corporates faced extreme difficulty

in meeting their debt servicing obligations to the banks/financial institutions, RBI introduced an out-of-court restructuring mechanism in the form of *CDR*. Through this institutional set up, corporates were able to maintain their investments and value and forestall bankruptcy, while the banks that participated in this programme and restructured corporate debts were able to minimise their exposure to those sick corporates and reduce credit risk, and hence lower fragility. According to CDR norms, the participating banks could retain the asset classification of restructured loans, and even could upgrade nonperforming restructured assets to a standard (performing) category after a specified period and charge less to their net income for loan loss provisions (Working-Group, 2012). By exploiting the CDR mechanism, many banks had the opportunity to understate the volume of non-performing loans while overstating their profitability. Though empirical studies on the effects of the DRTs Act (Visaria, 2009) and on the effects of SARFAESI Acts (Vig, 2013) on various banking issues are available, there is no study discussing whether the recently adopted institutional mechanism, *CDR*, was indeed fruitful in reducing risk-taking attitudes of Indian banks during a period when most of the banks around the world were going through unprecedented turmoil. Therefore, in this paper, we exploit the membership variation of individual banks in the *CDR* programme and empirically investigate whether the banks that have participated in this mechanism improve their stability. This study has contributed to the literature by exploring the efficacy of regulatory intervention in reducing the banks' exposure to non-performing corporate loans in the context of India.

The result shows that banking stability of the participating banks increases substantially after the implementation of the programme. From the economic policy standpoint, it is important to investigate the impact of the regulatory forbearance under the guise of the CDR system on the member banks' stability so that appropriate action can be taken to reduce excessive risk-taking not only by the Indian policymakers but also in other

emerging market economies in case of such widespread corporate sickness. Moreover, as the banking literature is divided and engulfed with the ambiguous conclusion that bank competition can both improve stability and worsen it (Keeley, 1990; Allen and Gale, 2004; Schaeck, Cihak and Wolfe, 2009; Martinez-Miera and Repullo, 2010; Beck, De Jonghe and Schepens, 2013; Anginer, Demirgüç-Kunt and Zhu, 2014), we also provide empirical evidence on this elusive nexus from an emerging economy–India–by using bank level data of almost two decades that includes multiple financial reforms. This complementary evidence would aid regulators in achieving the right balance between bank competition and stability.

Finally, in the last two essays–the main contributions of this thesis– using cross-country data from a number of sources, we investigate the effects of the most contemporary global policy issue–financial inclusion–on bank performance. Despite the remarkable benefits of access to finance on financial development and hence to inclusive economic growth, empirical literature on the issues related to bank performances is nonexistent. Perhaps the most closely related paper is the seminal work of Beck, Demirgüç-Kunt and Martínez Pería (2007) who investigate the determinants of financial sector outreach, and its role on a firm's financing obstacles. The limited research in this area is somewhat obvious given the limitations of supply- and demand-side data availability on access. In addition, the lack of development of reliable quantitative index of financial inclusion hitherto restricts explicitly analysing the effects of inclusive financial systems on various aspects of banking performance.

In chapter IV, using a unique dataset–*Financial Access Survey (FAS)*–we construct a multidimensional index of financial inclusion for 87 countries for the period 2004-2012, and investigate a new research question of whether the global policy drive towards greater financial inclusion is good for bank stability in a sample of 2,913 banks. The result that a more inclusive financial sector leads to greater bank stability, and this

nexus is reinforced while banks operate with high market power and in the countries with greater institutional setups, provides novel insights for regulatory authorities, banking supervisors and market participants. These results highlight that the importance of ensuring an inclusive financial system is not only a development goal but also an issue that should be prioritised by the financial institutions as such a policy drive is good for banks in terms of their stability.

This chapter makes several contributions to the literature. First, by constructing a composite index of financial inclusion for 87 countries around the world for the period 2004 to 2012, it shows empirically, for the first time, how the degree of financial inclusion affects bank-level stability. Second, since there is no extant study in academic or regulatory circles on such an important global policy issue, this study contributes to the debate on financial development and economic growth in a cross-country set up. Third, we contribute to the literature that explores the determinants of banking stability (e.g., Berger, Klapper and Turk-Ariss, 2009; Laeven and Levine, 2009; Houston, Lin, Lin and Ma, 2010; Beck, De Jonghe and Schepens, 2013; Anginer, Demirgüç-Kunt and Zhu, 2014). Fourth, it provides in-depth evidence on a policy debate drawing from a sample period that saw a massive upsurge in the regulatory efforts to broaden the access of the disadvantaged groups to financial services around the world. Finally, from a supervisory and policy perspective, it is important to understand whether broadening the access of the isolated poor people to formal financial services is complementary or antagonistic to the soundness of banks; therefore, the results of this study should prove useful to researchers and policymakers alike. Further policymaking for inclusive economic growth should also be benefited through supplementary findings that bank market power and institutional quality can augment the relationship between financial inclusion and bank stability.

In Chapter V, while extending chapter IV, we dig deep into another important aspect of bank performance, that of banks ‘shying away’ from extending financial services

to poor customers. Although giant strides have been made in recent years in the field of access to finance, there still remains an open question as to how bank level efficiency is influenced by an inclusive financial sector. In this essay, two imperative questions have been answered in a systematic manner: does financial inclusion affect bank efficiency? And similarly what is the role of bank competition and institutional quality on the relationship between financial inclusion and bank-level cost/profit efficiency?

The result that inclusive financial sectors enhance the levels of cost and profit efficiency of banks is critical for policymakers to spur inclusive economic growth as efficiency gains increase availability of more productive loans and overall economic development (Fries and Taci, 2005). Further evidence shows that the efficiency enhancing effects of financial inclusion is stronger when banks face lower competition and operate in countries with stronger rule of law and institutional quality. These findings on such an important contemporary policy issue would be useful to researchers and policymakers alike for making informed decisions on access policies and efficient intermediation of financial systems.

This chapter makes a few important contributions to the existing literature. First, this chapter fills an important gap in the literature by providing new evidence on the impact of financial inclusion on bank efficiency using an international sample of 2913 banks across 87 countries for the period 2004-2012. Second, it contributes to the literature on finance and growth by exploring the connection between important aspects of financial development and the efficiency of financial institutions. Well-functioning and efficient financial systems exert a first-order impact on economic growth and development (see e.g., Levine, 2005). Finally, this chapter contributes to the literature that explores the determinants of bank efficiency (e.g., Berger, Demsetz and Strahan, 1999; Rossi, Schwaiger and Winkler, 2009; Barth, Caprio and Levine, 2013; Chortareas, Girardone and Ventouri, 2013). Despite the extensive literature on bank efficiency (see Berger, 2007, for

reviews of the literature), an empirical study on whether an inclusive financial sector increases or decreases efficient operation of banks does not yet exist.

1.3 Structure of the thesis

This thesis can be divided into two parts: the first part is dedicated to the understanding of market structure and credit risk of Indian banks on performance over the last two decades (Chapter II and III), and the second part is devoted to the empirical analysis of the financial inclusion-bank stability/efficiency nexus containing two chapters (Chapter IV and V). The remainder of the thesis is organised as follows.

Chapter II contains the first essay of this thesis. This essay comprises an analysis of the relationship between credit risk, income diversification and profitability using panel dataset of Indian banks for the post reform periods. Following a detailed review of the literature on bank market structure, the influence of bank size/ownership structure on the association between credit risk/income diversification and profitability, this paper empirically tests whether credit risk and income diversification interacting with bank size or ownership affect bank profitability. This chapter also provides numerous robustness tests in support of the evidence found in the main analyses.

Chapter III extends the credit risk arguments of Chapter II and digs deep into the most contemporary but contentious regulatory issue of the Indian banking sector. This paper estimates the causal effect of a unique programme–Corporate Debt Restructuring (CDR)–on the stability of Indian banks for the period 1992-2012 by using difference-in-differences approach. Following the recent development in measuring market power, this paper also estimates efficiency-adjusted Lerner indices along with a conventional one using a stochastic frontier analysis approach, to check for the interactive effect of CDR on bank stability. To provide unbiased treatment effects of CDR eliminating any sample

selection problem, it also provides supporting evidence by using a number of alternative matching estimators including the recently developed bias-corrected covariate matching estimator. Finally, this paper investigates the ambiguous trade-off between market power and stability for a sample period that includes multiple reforms and structural changes in India.

Chapter IV provides novel evidence in the banking literature by investigating the relationship between financial inclusion and bank stability (i.e., access-stability) using a large international sample. This paper first constructs a multidimensional index of financial inclusion for 87 countries for the period 2004-2012 using a unique survey dataset– Financial Access Survey (FAS), and then examines a new research question as to whether the global policy drive towards greater financial inclusion is good for bank stability in a sample of 2,913 banks. It employs instrumental variable (IV) estimators to extract the exogenous component of financial inclusion to address concerns about endogeneity. This paper also investigates whether the access-stability relationship changes due to higher market power and the institutional settings in which banks operate. Finally, it substantiates the empirical evidence by exploiting cross-country and temporal variation in the timing of countries into a global network of financial inclusion policymakers, and shows how an enabling inclusive financial environment enhances the soundness of banks using a "Quasi-natural experiment" approach. In the end, policy implications are discussed that should be important for all stakeholders in the universe of financial systems.

Chapter V expands the analysis of Chapter IV and examines the effects of financial inclusion on bank cost/profit efficiency. By incorporating multiple access dimensions in constructing a composite index of financial inclusion at country level, this paper links the bank-level cost and profit efficiency scores obtained from stochastic frontier analysis (SFA), a technique that is extensively used in measuring the efficiency of individual banks. Considering the importance of bank competition and institutional setups

on access to finance, this paper also examines the interactive effect of financial inclusion with bank-level competition and country-level institutional qualities. To provide robust evidence, this paper uses alternative measures of financial inclusion and bank efficiency, alternative samples and methodologies including instrumental variable analysis. Finally, it explores the effects of a network of financial inclusion policymakers–which sets the stage for many enabling laws in the member countries to broaden the access of the poor people to financial services–on the levels of cost/profit efficiency of banks following some policy implications.

Chapter VI provides the overall summary of this thesis and concludes with policy implications that have been drawn from the findings of four empirical essays. The conclusion also substantiates the inherent limitations of the thesis and suggests tentative areas for future research.

Chapter II

The Profitability of Indian Banks: Do Size and Ownership Matter in the Impact of Credit Risk and Income Diversification?

Abstract

Following the two-decade long experience of financial reforms in the Indian banking sector, it has become important to assess whether credit risk impairs the profitability of Indian banks. This paper examines the effect of bank-level credit risk and ownership structures on bank performance while controlling for market-specific and macroeconomic determinants, over the period 2004-2011. We find that market concentration has a positive impact on the profitability of Indian banks, suggesting large banks dominate the entire banking industry. The marginal effect of credit risk indicates that the negative impact of non-performing loans (as a measure of credit risk) on profitability decreases with bank size, yielding a threshold level of bank size. This negative impact of credit risk is more pronounced for the foreign banks (although they account for a small proportion of the loan market) relative to the public and private domestic banks. Besides, the marginal effect of income diversification indicates that the positive impact of non-interest income increases as bank size gets bigger. In addition, we observe the effect of non-interest income being stronger for the public banks during the post-reform period. These results hold against an array of robustness tests.

2.1 Introduction

In the last two decades, despite the Indian banking sector having undergone multiple financial reforms, still state-owned banks dominate the entire sector with almost 70% of deposits and assets.[1] Though the *de novo* entry of private domestic and foreign banks has enhanced the competitive environment over the years, the size of individual banks and/or ownership structure still remains one of the important moderating factors for how these banks manage their credit risk and diversify their sources of revenue for higher profitability. Therefore, in this chapter, we examine the determinants of profitability of Indian banks and also investigate whether bank size and/or ownership structure matter in the impact of credit risk and income diversification for the period 2004 to 2011.

The motivation to conduct this research stems from several factors. First, RBI in its 2002-2003 report urged banks to reduce operating expenses and pursue non-interest sources of income.[2] Since the 2004-2005 financial year, though Indian banks have observed strong growth in assets their income from investments activities has gone down due to the rising interest rate in the market.[3] Furthermore, in 2002-2003, RBI introduced the *CDR* programme for restructuring corporate loans. By using this mechanism, member banks of *CDR* could understate nonperforming loans while overstating profitability (see Chapter III for details on *CDR*). Most of the banks that have participated in *CDR* are state-owned and large banks. It is reasonable to believe that small and large banks and/or public and private banks (including foreign banks) have distinct comparative advantage in dealing

[1] See for example, Klapper, Martinez-Peria and Zia (2015)
[2] The RBI report on *Trend and Progress of Banking in India, 2002-2003* states that "the future profitability of public sector banks would depend on their ability to generate greater non-interest income and control operating expenses". The concluding remark of that report was "Harnessing technology to improve productivity so as to produce highly competitive types of banking and generating greater non-interest income by diversifying into non-fund based activities will be important features of the Indian banking of tomorrow".
[3] In March 2004, the interest rate of 5-year government security was 4.78%, which increased to 6.36% in March 2005. Therefore, banks which had large portion of fixed income investments suffered a sharp decline in profitability as bond prices went down although the interest income went up for the higher interest rate. In the front of 'other income' component their profits had declined by 15.1% (RBI, 2005a).

with various facets of banking activities such as credit risk management and income diversification. This empirical chapter will complement the existing studies on India (Sarkar, Sarkar and Bhaumik, 1998; Pennathur, Subrahmanyam and Vishwasrao, 2012) while disentangling the role of bank size/ownership in the impact of credit risk/income diversification on profitability. Since a profitable financial system absorbs negative shocks at a macro level, the results of this study would be useful for policymakers to identify any unstable economic conditions (Athanasoglou, Brissimis and Delis, 2008; Albertazzi and Gambacorta, 2009), which would be important for bank supervisors to take necessary steps for ensuring sufficient competition and stability in the banking sector.

Second, recent literature shows that the differences in resources, expertise and objectives between large and small banks to monitor loans may have considerable influence on the lending decisions they make and the ways they conduct their business activities for profit (e.g., Berger, Dick, Goldberg and White, 2007; Mercieca, Schaeck and Wolfe, 2007; Stever, 2007; Goddard, McKillop and Wilson, 2008; Lepetit, Nys, Rous and Tarazi, 2008). It is also documented in the literature that different ownership types do have unique sets of objectives and the ways they manage credit risk and diversified portfolios.[4] Regarding Indian public sector banks, it is possible that there is the existence of a complex principal-agent problem as 51% of the shares of the banks are owned by the government. These banks therefore may enjoy less monitoring as other shareholders have little incentive to exercise due diligence and monitor the management performance (see, Jiang, Yao and Feng, 2013). This also echoes with the RBI reports which emphasise the complex principal-agent relationships due to government ownership in the banks.[5] In this case,

[4] Pennathur, Subrahmanyam and Vishwasrao (2012) state "in the Indian context, for example, the pursuit of non-interest sources of income is risky because of the lack of prior experience, nascent or non-existent financial networks, and cost and lack of technology, especially at the public sector banks and small private domestic banks".

[5] The *Trend and Progress of Banking in India*, *2002-2003* report of RBI states that "A feature unique to the Indian financial system relates to the dominance of Government ownership in the public sector banking system in India. To the extent there is public ownership in banks, there are possibilities of multiple objectives

understanding the interactive effects of bank size/ownership structure and credit risk/income diversification on profitability would be vital for articulating effective policies that could create a level playing field for all banks.

Finally, we also contribute to the literature drawing evidence from an emerging market economy–India– that consists of mixed ownership groups and heterogeneous bank sizes. In the last two decades, most of the emerging market economies reduced the share of assets held by the government banks in the banking sectors. For example, between 1997 and 2009, government ownership in Bangladesh and Pakistan fell from 70% to 35% and from 68% to 21%, respectively. Over this period, other Asian countries – South Korea and Thailand – also witnessed a decline (both, from 30% to 22%) in government ownership. Although China started banking reforms in the early 2000s, government ownership has fallen by almost 21% in the same period (for details, see Klapper, Martinez-Peria and Zia, 2015). Furthermore, most of the Latin American banking sectors have also witnessed significantly declining government ownership. For example, between 1990 and 2010, government ownership in the Brazilian banking sector fell from 54% to 34%. For the same period, the Mexican government reduced its share of assets in the banking sector from 98% to 0.3% (for details, see De Carvalho, De Paula and Williams, 2015). However, despite having multiple financial reforms in the last two decades, government ownership in the Indian banking sector has just fallen from 80% to 72%. Since state-owned banks in most of the developing countries may have certain social development objectives, which are not tied to generating high operating income, and India being the fastest growing economy in the world with mixed ownership groups, where state-owned banks still play a critical role in providing access to credit, the Indian banking sector therefore provides an excellent laboratory in which to examine how ownership and bank size matter in the impact of credit

of the Government as owner and the complex principal-agent relationships".

risk/income diversification on profitability.

Empirical evidence on this strand of literature is mostly based on developed market economies (e.g., Mercieca, Schaeck and Wolfe, 2007; Stever, 2007; Goddard, McKillop and Wilson, 2008), and studies on the Indian banking sector are rather limited. Recently, Pennathur, Subrahmanyam and Vishwasrao (2012) have shown that Indian public sector banks earn significantly less non-interest income compared to foreign banks. However, the role of bank size on the effect of credit risk/income diversification is still unexplored. Therefore, the findings of this paper will provide substantial understanding to take bank size heterogeneity into consideration while formulating policies in order to augment financial stability.

We use bank-level data of 73 banks over the period 2004 to 2011. The empirical results show that large banks still dominate the entire banking industry and earn higher than normal profits through non-competitive price settings. We also find that Indian bank profitability is positively influenced by bank size, income diversification, capital adequacy, public sector dummy and negatively influenced by credit risk, operational inefficiency, inflation, interest rates and GDP growth rate. The marginal effect of credit risk indicates that the negative impact of non-performing loans on profitability decreases with bank size, the significant negative effect even becomes reductive once the bank size reaches a threshold point. The evidence also highlights that the negative impact of credit risk is pronounced for the private foreign banks but not for the public and private domestic banks. The marginal effect of income diversification indicates that the positive impact of non-interest income increases as bank size gets bigger. In addition, we observe that non-interest income ameliorates the profitability of all ownership types, with the effect being stronger for the public sector banks.

The rest of this paper is organized as follows: Section 2.2 provides an overview of

the Indian banking sector whereas section 2.3 discusses the literature and empirical hypotheses. Sections 2.4 and 2.5 specify the model for estimation and describe the variables and descriptive statistics, respectively. Section 2.6 presents the main empirical results and sensitivity analyses. Section 2.7 concludes with some policy implications and limitations of this study.

2.2 The Indian banking system

The Indian banking system comprises a large number of banks with heterogeneous size and ownership. There are 26 public banks in which the government has majority ownership, 21 private banks and 38 foreign banks as of 2011. The public sector banks constitute a 73.7% share in the assets of the banking system, while private domestic and private foreign banks constitute only 19.5% and 6.7%, respectively. These commercial banks are regulated and monitored by the RBI.[6]

Prior to liberalisation and the initiation of banking sector reform in the early 1990s, the banking sector used to be heavily regulated with the aim to achieve social and economic development objectives. The predominant establishments were the large-scale pre-emption of banks' resources through Statutory Liquidity Ratio (SLR), Cash Reserve Ratio (CRR), an administered interest rates regime, credit guarantee schemes and lending to priority sectors at concessional interest rates (Pennathur, Subrahmanyam and Vishwasrao, 2012).[7] The net effect of these controls resulted in an inefficient allocation of resources, high operating costs and deteriorated asset quality.

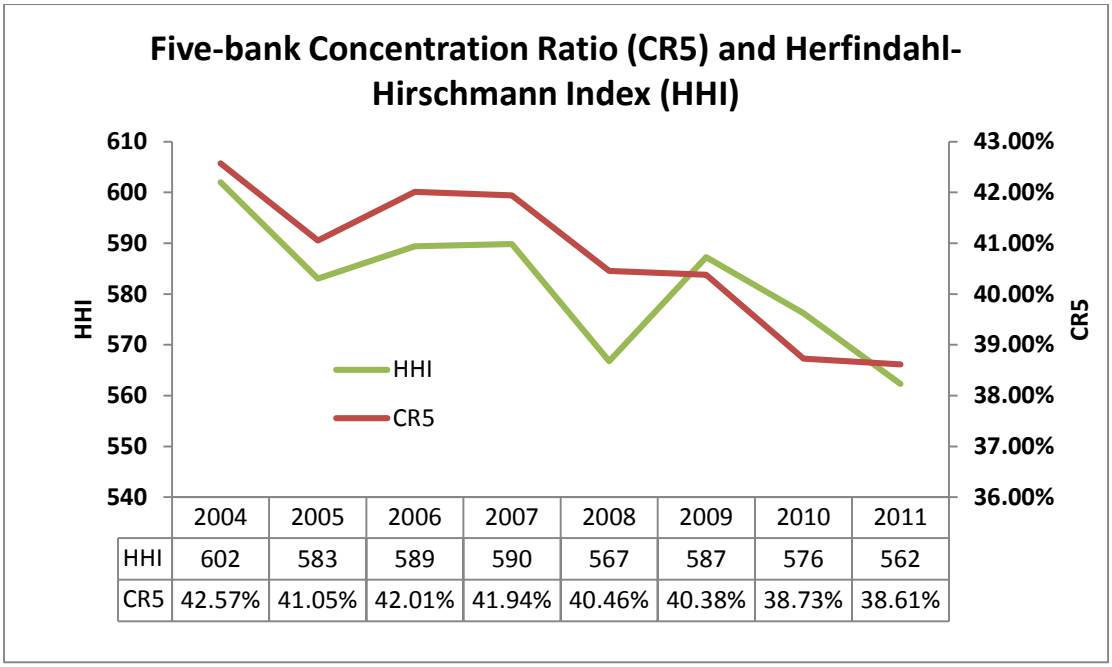
In 1992, the RBI started the liberalisation process stressing deregulation and opening up of the banking sector to market forces. It has been consistently working towards not only the establishment of a sound regulatory framework with prompt and

[6] The Indian banking system consists of two types of banks *viz.* commercial and co-operative banks. Together they are referred to as Scheduled Commercial Banks, as they are included in the Second Schedule of the RBI Act, 1934.

[7] The SLR and CRR were 24% and 5%, respectively as of 2011. The corresponding figures as of 1994 were 34.25% and 14.0%, respectively.

effective supervision but also the development of technological and institutional infrastructure (Allen, Chakrabarti and De, 2007). The major reforms which have improved the competitiveness and efficiency in the resource allocation process of the banking sector and strengthened the transmission mechanism of monetary policy include reduction in SLR/CRR, permission for de novo entry of banks in the private sector, deregulation of interest rates, adoption of capital adequacy norms, prudential norms for asset classification and provisions in line with global practices.

Figure 2.1
CR5 and HHI calculated on the basis of total loans of the market.



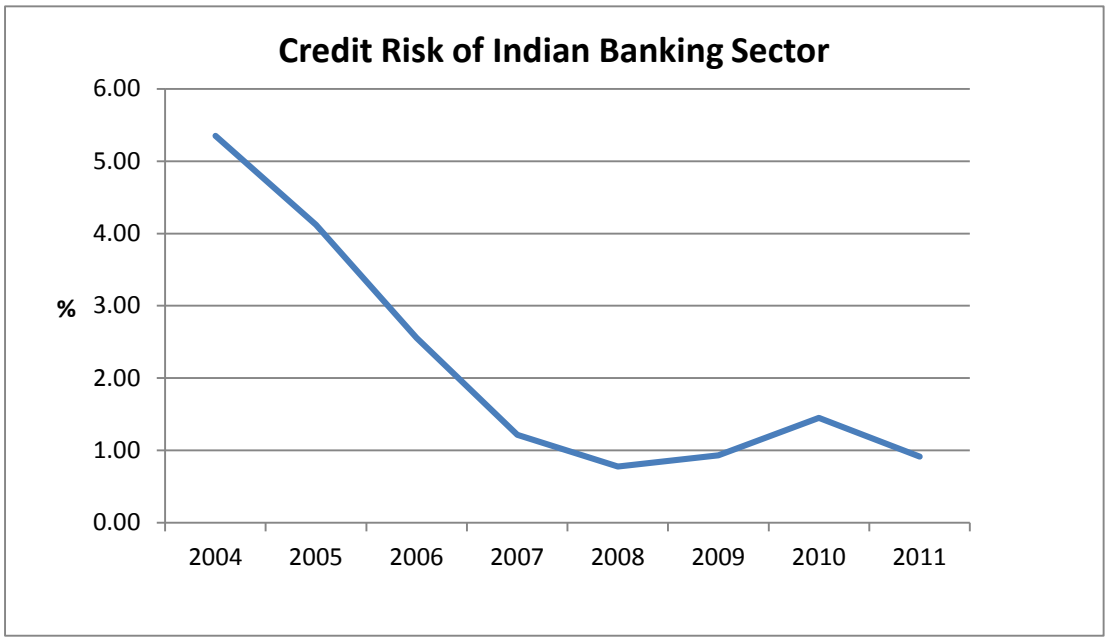
	2004	2005	2006	2007	2008	2009	2010	2011
HHI	602	583	589	590	567	587	576	562
CR5	42.57%	41.05%	42.01%	41.94%	40.46%	40.38%	38.73%	38.61%

The state-owned public commercial banks used to dominate 80% of the deposits and assets of the Indian banking industry. Since liberalisation, with the emergence of new private and foreign commercial banks, state-owned banks have lost market share to their competitors over the years. For instance, ICICI bank, a private bank, within a decade of its formation, became the second largest bank in India (Allen, Chakrabarti and De, 2007). The concentration level of the Indian banking industry has seen a decrease over the study period (Figure 2.1). The five-bank concentration ratio (CR5) was 42.6% in 2004 and it came down to 38.6% in 2011. A similar pattern is observed for Herfindahl-Hirschman Index, which is

a clear sign of the improving competitive conditions of the banking sector.

In the early 1990s, the NPL was almost 27%, the high standard of selecting borrowers and proper allocation of loans; however, Indian banks made it possible to bring it down to 0.73% in 2008, which can be gleaned from Figure 2.2. However, the upward trend between 2008 and 2011, is a worrying sign for the soundness of the banking sector; this could be due to the global financial crisis and liquidity crunch in 2008. Until recently banks were allowed to restrcuture coporate loans with a provision of 2% but it was raised to 5% by RBI on June 2013.[8] Among all types of banks, state-owned banks would be stricken hardest by the deteriorating assets quality which is a great cause for concern for the regulators.[9]

Figure 2.2
Credit risk defined as the ratio of net nonperforming loans over net loans.



[8] After the global financial crisis in 2008, the liquidity crunch and slowdown in the global markets required banks to restructure their corporate loans (Corporate Debt Restructuring). It is estimated that 10-15% of the loans restructured then are believed to have turned bad. It is noted that foreign private banks, those who operate in India, are not allowed to restructure their corporate debt.
[9] Unnikrishnan, D., "Restructured Loans of Banks tops Rs. 2.5 trillion", July 2013 http://www.livemint.com/

The multiple reforms resulted in unprecedented changes in market structure, patterns of ownership and financial operations of Indian commercial banks. The increasing adoption of technology has rendered improved productivity and fierce competitiveness among the banking groups, which led them to focus beyond traditional banking activities. In recent years, banks have generated twice as much non-interest income by diversifying into non-traditional activities as they earned in the early 1990s (10% of the total income). The efforts of earning greater non-interest income from non-fund based activities have increased tremendously in recent years after the categorical recommendations of the RBI in the 2002-03 report, where it suggests that public sector banks should focus on generating greater quantum of non-interest income in order to be profitable in the future.[10]

2.3 Literature review and hypothesis development

Recently, following the banking study of Short (1979) and Bourke (1989), numerous studies have been undertaken to explore major determinants of profitability. These studies can be classified into two groups. The first set of empirical studies has focused their analysis on cross-country evidence. The notable studies on the cross-country framework include Demirgüç-Kunt and Huizinga (1999), Goddard, Molyneux and Wilson (2004), Staikouras and Wood (2011). The second set of studies which focused their analysis on individual countries includes Berger, (1995a), Athanasoglou, Brissimis and Delis (2008), Ben Naceur and Goaied (2008), García-Herrero, Gavilá and Santabárbara (2009), Dietrich and Wanzenried (2011), and Curak, Poposki and Pepur (2012). Given the heterogeneity of datasets, time periods and countries, it is obvious that the empirical findings of these studies cannot be generalised to the context of the Indian banking sector, which has, in the recent past, gone through a phase of decline in economic growth, assets

[10] The Report on Trend and Progress of Banking 2002-03 suggests that the future profitability of public sector banks would depend on their ability to generate greater non-interest income and control operating expenses.

quality and non-interest sources of income.

In general, bank profitability is a function of internal and external determinants. The internal determinants are related to micro or bank-specific factors that originate from balance sheets and/or profit and loss accounts. These factors are influenced by the management decisions and policy objectives (Staikouras and Wood, 2011). The important bank-specific factors include market share, bank size, capital adequacy, credit risk, liquidity risk, operational efficiency and income diversification. Different sized banks may have different abilities to reap economies of scale or scope through diversification, market power, stronger band image or implicit regulatory (too-big-to-fail) protection (Curak, Poposki and Pepur, 2012). Numerous studies have found a significant positive relationship between size and profitability (Goddard, Molyneux and Wilson, 2004; García-Herrero, Gavilá and Santabárbara, 2009; Chortareas, Garza-Garcia and Girardone, 2011) (see sub-section 3.2). The glimpse of efficient cost management can be taken from the ratio of operating expenses over total assets. Higher ratio is related to higher expenses and will have a negative impact on profitability (Athanasoglou, Brissimis and Delis, 2008). The most common and serious risks that banks encounter in day-to-day operations are credit risk, solvency risk and liquidity risk. The credit risk is measured as the ratio of net non-performing loans over total net loans. It is negatively related to bank performance; however, bank size or ownership can have a significant influence on the negative effect of credit risk (see sub-section 2.3.3).

Well-capitalised banks are considered safe and solvent to absorb any unexpected shock. To account for insolvency risk of individual banks, capital adequacy ratio is considered. It is measured as equity capital over total assets, and a positive relationship is expected. Liquidity risk is the inability of banks to pay their obligations as quickly as possible, and failure to do so can lead to bank failure (Curak, Poposki and Pepur, 2012). It is measured as the ratio of total loan over total assets. A positive relationship is expected

with profitability since highly liquid banks are more aggressive towards profitability (Hesse and Poghosyan, 2009; Chortareas, Garza-Garcia and Girardone, 2011). A bank with higher diversified non-interest income streams is considered to be more profitable and is cushioned from a volatile environment. To account for an individual bank's income diversity, the ratio of non-interest income over total income is considered. It is argued in the literature that bank size or ownership does matter in the pursuit of non-interest income, and accordingly to the bank's profitability (see sub-section 2.3.4).

The external determinants are comprised of macroeconomic and market-specific variables (Athanasoglou, Brissimis and Delis, 2008; Staikouras and Wood, 2011). These variables are outside of the prerogative of bank-specific decisions and policies. To control for the macroeconomic environments, most of the previous studies used inflation, real interest rate, and real GDP growth rate. The impact of inflation on profitability is substantial, and any major fluctuation in inflation can have serious implication towards banking profitability and to some extent to the stability of the financial system (Revell, 1979). However, the effect of inflation is ambiguous. Some studies (e.g., Demirgüç-Kunt and Huizinga, 1999; Athanasoglou, Brissimis and Delis, 2008) find a positive relationship whereas others find a negative relationship between inflation and profitability. Real interest rate volatility fosters bank profits since banks transfer these risks to consumers (Maudos and de Guevara, 2007) particularly in developing countries (Demirgüç-Kunt and Huizinga, 1999). The relationship between GDP and profitability is ambiguous. On the one hand, a positive relationship is expected because of the pro-cyclical nature of the banking business (Athanasoglou, Brissimis and Delis, 2008; Chortareas, Garza-Garcia and Girardone, 2011). During the boom period, banks in general expand lending and charge higher interest rates on loans as well as generate higher fee income through ever increased transactions in the stock market. Banks generate fewer bad assets (NPLs) and ultimately

earn higher returns. On the other hand, Goddard, Liu, Molyneux and Wilson (2011) argue that an abundance of business opportunities might lead to an intensification of competition and thus a negative relationship between GDP and profitability can be expected. Again, during an economic downturn with slow growth environment, in particular in a period of recession, credit quality deteriorates, and default increases, thus bank profitability declines (Flamini, Schumacher and McDonald, 2009).

The industry/market-specific variables can have a significant impact on banking profitability as ownership-structure and market structure. Athanasoglou, Brissimis and Delis (2008) state that a relationship between ownership-structure and profitability may exist; however, they find no clear evidence in the literature to support this view. Sarkar, Sarkar and Bhaumik (1998) find evidence of a weak ownership effect of private over public banks in India for the period 1993-1994 and 1994-1995. However, Bhaumik and Dimova (2004), for the sample of Indian banks for the period 1995-1996 through 2000-2001, find no evidence of ownership effect on performance, and conclude that due to intensified competition among the ownership groups public banks have managed to eliminate the performance gap (see sub-section 2.3.2). The literature on the impact of market structure on banking profitability is extensive and linked to the traditional industrial organisation theory. In the following sub-sections, we discuss the effect of market structure on profitability, the role of bank size and ownership on the impact of credit risk and/or income diversification on profitability.

2.3.1 Market structure and profitability

A plethora of research has been devoted to the determination of the connection between market structure and profitability. Many studies, which are related to the traditional industrial organisation theory, find a positive relationship between them. Two competing hypotheses are developed in relation to market structure and profitability,

namely market power (MP) and the efficient structure (ES) hypothesis. Along with these hypotheses, recent studies (e.g., Berger, 1995a; Claeys and Vander Vennet, 2008) focus on the profit-efficiency relationship by identifying *X*-efficiency and scale-efficiency.[11] Lately both hypotheses have been used in a single equation framework to investigate the effect of bank-specific, market-specific and macroeconomic determinants of profitability (e.g., Athanasoglou, Brissimis and Delis, 2008; Chortareas, Garza-Garcia and Girardone, 2011; Staikouras and Wood, 2011; Mirzaei, Moore and Liu, 2013).

The market power hypothesis is divided into traditional structure-conduct-performance (SCP) and relative market power (RMP) hypothesis. SCP suggests that the conduct and performance of the banks depend on the structural characteristics of the market in which they operate. It asserts that banks which operate in a concentrated market are able to extract monopolistic rents by using their market power to charge higher interest rates on loans and offer lower rates on deposits (Staikouras and Wood, 2011). This setting of prices is less favourable to consumers' welfare. Since concentration is linked to the degree of competition, a greater concentrated banking industry is considered to have a lower degree of competition and is conducive for implicit/explicit collusion among banks to earn higher than normal profits (Bain, 1951).[12] However, if the concentration falls, the price of the banks gets closer to marginal cost and as a result there is a fall of market power of large banks and, hence competition increases. The SCP hypothesis would hold if we find a significant positive relationship between market concentration and profitability. The recent banking studies that find support for the SCP hypothesis are by Lloyd-Williams,

[11] *X*-efficiency hypothesis postulates that banks with greater managerial efficiency and/or better technologies and/or production processes have lower costs and therefore higher profits, and the scale-efficiency hypothesis states that sometimes despite having similar production and management technology some banks can operate at an optimal level of economies of scale, and hence can reduce their unit costs and earn higher unit profits.

[12] Implicit collusion may occur through barometric price leadership and explicit collusion may occur through cartel agreement which enables banks to operate at the point of joint profit maximisation (Goddard, Molyneux and Wilson, 2001).

Molyneux and Thornton (1994) on Spain, Molyneux and Forbes (1995) on 18 European Countries, Claeys and Vander Vennet (2008) on Central and Eastern European countries; Al-Muharrami and Matthews (2009) on the industry of Arab Gulf Cooperation Council (GCC), Sufian (2010) on Republic of Korea, Bhatti and Hussain (2010) on Pakistan, and Ahamed (2012) on Bangladesh.

Since the initiation of financial liberalisation of the Indian banking industry, there have been significant changes in the market structure mainly through consolidation of banks and participation of foreign banks into the system. These changes can intensify the market power of the large banks by fostering collusive behaviour among them and hence hinder competition, profitability and productive efficiency. The concentration indices reveal that the Indian banking industry is still moderately concentrated and around 40% market share is in the hands of the five largest banks (see Figure 2.1). Therefore, we believe that concentration has a significant positive impact on profitability of the Indian banking industry, suggesting the SCP hypothesis is valid for India.

The opponents of the SCP hypothesis argue however that there is also a reverse causality, as such performance of banks can affect the conduct and in turn the structure of the market. According to the RMP hypothesis, banks with greater market share and well differentiated products are able to exercise market power in setting prices for those products and earn supernormal profits (Berger, 1995a). The subtle difference between SCP and RMP is that in the latter case banks can earn supernormal profits and it does not have to occur in the concentrated market (Goldberg and Rai, 1996). Demsetz (1973), Peltzman (1977) and Smirlock (1985) argue that market concentration is not a random event but rather the result of banks with superior efficiency obtaining a large market share. In this case, market share and profits will be correlated but there will be no causal relation between market concentration and profits (Smirlock, 1985). Evanoff and Fortier (1988) also argue that higher profits in concentrated markets could be the result of greater

productive efficiency of firms (through economies of scale and/or new technologies) with larger market share. Therefore, a positive relationship between market share and profitability yield support for the RMP hypothesis. The recent banking studies that find support for RMP hypothesis are by Fu and Heffernan (2009) on China and Garza-Garcia (2012) on Mexico.

2.3.2 Bank size, ownership and profitability

The empirical findings on the relationship between bank size and profitability are conflicting. While studies by Goddard, Molyneux and Wilson (2004) on European, Flamini, Schumacher and McDonald (2009) on Sub-Saharan African and Chortareas, Garza-Garcia and Girardone (2011) on Latin American countries find that large banks are more profitable, studies by Smirlock (1985) on the US find the opposite result. Goddard, Molyneux and Wilson (2004) explain several factors that are the reason for large banks being profitable. Large banks can exploit scale and scope economies, market power through stronger brand image or implicit regulatory (too-big-to-fail) protection. In addition, by exercising market power in wholesale or capital markets, large banks can contribute substantially to their profitability. Alternatively, if large banks cannot exploit economies of scale due to possible bureaucratic bottlenecks, managerial inefficiencies and complex organizational structure they are likely to be less profitable than the smaller ones (Flamini, Schumacher and McDonald, 2009). In a review, Berger and Humphrey (1997) find consistent evidence that large banks are more efficient on average than small ones. The efficiency studies on India also find similar results that large banks are more efficient because of scale economies (Das and Ghosh, 2006, 2009; Tabak and Tecles, 2010; Bhattacharyya and Pal, 2013). On the other hand, Bonin, Hasan and Wachtel (2005), in transition countries, find that small banks are more efficient.

The distinctive institutional objectives and management structures of different

banking groups impact the profitability differently. Like the relationship between size and profitability, the literature that analyses the influence of different ownership types on banking profitability also renders divergent conclusions. While some empirical studies find evidence of foreign banks being more profit efficient (e.g., Berger, Hasan and Zhou, 2009; Sahoo and Tone, 2009), others find evidence of public banks being more efficient (Das and Ghosh, 2006, 2009; Tabak and Tecles, 2010). Micco, Panizza and Yanez (2007), for the industrial countries, did not find any evidence to support the idea that privately-owned banks are more profitable than state-owned banks; however, they did find support for the developing countries. In addition, Iannotta, Nocera and Sironi (2007) conclude that publicly-owned banks demonstrate lower profitability than their counterparts because of higher risk associated with financing projects. Conversely, Dietrich and Wanzenried (2011) find that Swiss public-owned banks are more profitable than privately owned banks during a financial crisis. Regarding India, Sarkar, Sarkar and Bhaumik (1998) find that foreign banks are more profitable than public banks and domestic private banks show a weak advantage over public banks in the earlier liberalization period. However, most of the studies on the post liberalization period show a convergence or improvement in the banking performance (e.g., Bhaumik and Dimova, 2004). With respect to both costs and profit, most of the recent studies show that public sector banks are more efficient than private domestic and foreign banks (e.g., Sensarma, 2006; Ray and Das, 2010; Bhattacharyya and Pal, 2013; and to name a few).

2.3.3 Credit risk and bank profitability

Hypothesis 1: The negative impact of credit risk on profitability in the form of non-performing loans differs across ***bank size groups****.*

Hypothesis 2: The negative impact of credit risk on profitability in the form of non-performing loans differs across ***ownership types****.*

Many theories suggest that credit risk reduces banking profitability. Theories mainly emphasise the negative impact of credit risk on profitability in the form of nonperforming loans. The underlying premise of their argument is that bad loans, or accumulation of unpaid loans, reduce the amount of good loans which lowers the returns of banks. García-Herrero, Gavilá and Santabárbara (2009) point out that poor asset quality has a negative impact on the bank returns. In general, the higher the exposure to credit risk, the lower the bank's profitability (Athanasoglou, Brissimis and Delis, 2008; Hesse and Poghosyan, 2009).[13] Berger and DeYoung (1997) advocate that efficient banks are good at managing their credit risk and propose a 'bad management' hypothesis, in which non-performing loans increase due to poor management practices in the form of poor loan underwriting, monitoring and control, and thereby banks become cost inefficient. According to Das and Ghosh (2009), cost inefficiency is a major source of performance inadequacy in banks. Most of the recent efficiency studies have taken asset quality into account and have found that a high level of non-performing loans does make banks inefficient (e.g., Altunbas, Liu, Molyneux and Seth, 2000; Girardone, Molyneux and Gardener, 2004; Das and Ghosh, 2009).

For identifying creditworthy borrowers and monitoring loans, banks need to have an effective credit risk management system in place, to reduce the exposure of credit risk and maximise a bank's risk-adjusted rate of return. In the context of India, large and medium sized banks are found to be more efficient than their smaller counterparts (e.g., Das and Ghosh, 2009). It is argued that large Indian banks are better able to adjust their optimal mix and scale of outputs and hence become more profit efficient. Comparatively large banks have better infrastructure, managerial skills, and geographical spread in terms of branch networks to differentiate good and bad borrowers and disburse loans to

[13] Hesse and Poghosyan (2009) suggest that non-performing loans over total loans provide better reflection of credit risk for banks.

creditworthy customers. According to Berger and Udell (2002), small banks rely on soft information and are good at making relationships with customers and, thus making quick lending decisions. On the other hand, large banks always rely on hard information and make mostly transaction-based lending (Berger, Miller, Petersen, Rajan and Stein, 2005). Therefore, we develop hypothesis 1 to test whether bank size heterogeneity influences the impact of credit risk on profitability.

According to Bhaumik and Piesse (2008), since the emerging market is undergoing substantial reforms, credit disbursal behaviour may vary significantly across banks of different ownership types. Even after two decades of financial liberalization, state-owned banks, along with profit maximizing objectives, have a unique set of peripheral objectives, e.g., encouraging employment of low-skilled workers, expanding bank branches in the rural areas to promote job opportunities, disbursing loans to government priority sector at below market rates (Das and Ghosh, 2009), which might yield low returns. However, it has been noted in recent studies that medium-sized state-owned banks have, on average, less non-performing loans which may be due to high level of technical efficiency (e.g., Das and Ghosh, 2006, 2009). Regarding Indian bank ownership types and banking relationships, Berger, Klapper, Peria and Zaidi (2008) find that different ownership types build divergent relationships. They find that state-owned banks have more relationships with state-owned firms and rural firms than private banks, whereas foreign banks have a stronger relationship with more transparent firms or corporate and large firms. All these differences across ownership types may have a significant impact on credit quality (e.g., non-performing loans) which ultimately rolls on to profitability. Therefore, we develop hypothesis 2 to test whether bank ownership heterogeneity influences the effect of credit risk on profitability.

Since credit quality is considered one of the main indicators of the financial soundness and health of a bank, default on loans and advances and/or low asset quality

have important repercussions for the entire economy of a country. While there is evidence of a negative impact of credit risk on profitability, there is admittedly limited or no evidence for the influence of bank size or ownership on the impact of credit risk on profitability. Empirical verification, in the context of Indian banks which were saddled with non-performing loans, to examine the relationship between credit risk and profitability and whether bank size or ownership heterogeneity has any significant influence on the impact of credit risk would provide a better understanding to adopt necessary measures in order to augment financial stability.

2.3.4 Income diversification and bank profitability

Hypothesis 3: The positive impact of income diversification on profitability in the form of non-interest income differs across ***bank size groups****.*

Hypothesis 4: The positive impact of income diversification on profitability in the form of non-interest income differs across ***ownership types****.*

According to economic theory, if revenue stems from various financial activities and those are less than perfectly correlated it should increase the bank profitability. The conventional industry wisdom suggests that banks with greater diversification through non-traditional sources of income are capable of reducing income volatility substantially. To disentangle the question of whether diversification enhances profitability has been explored comprehensively both theoretically and empirically (e.g., Stiroh, 2004; Acharya, Hasan and Saunders, 2006; Stiroh and Rumble, 2006; Mercieca, Schaeck and Wolfe, 2007; Elsas, Hackethal and Holzhäuser, 2010).

The underlying findings of these systematic studies are mixed and mostly based on developed market economies (e.g., US and Europe). The empirical studies that find positive impact of diversification on profitability are by Baele, De Jonghe and Vander Vennet (2007) on 17 European countries, Chiorazzo, Milani and Salvini (2008) on the

Italian banking industry and Elsas, Hackethal and Holzhäuser (2010) on nine developed countries' banking markets. Well-diversified banks can materialise many benefits through non-intermediation activities. Among the identified benefits, Elsas, Hackethal and Holzhäuser (2010) cite efficiency gains through economies of scale and scope, superior resource allocation through internal capital markets, and bank-specific competitive advantage. Goddard, McKillop and Wilson (2008) cite the reduction of idiosyncratic risk, and the strengthening of the financial system as the motives for diversification.

Recent literature embarks on the inherent differences between large and small banks and their capability of adopting diversification strategies to enhance profitability. It is argued that due to superior technological infrastructure, expertise and economies of scale and scope, large banks tend to outperform small ones in diversifying investments. Mercieca, Schaeck and Wolfe (2007) examine the impact of diversification on the performance of small European banks for 15 countries for the period 1997-2003. They did not find any direct diversification benefits for the small banks either within or across business lines. On the other hand, for the Italian banking sample, Chiorazzo, Milani and Salvini (2008) find a stronger relationship between diversification and profitability for the large banks. For US credit unions, Goddard, McKillop and Wilson (2008) and Goddard et al. (2008) suggest that similar diversification strategies are not appropriate for the large and small credit unions. They advocate that small credit unions should limit diversification towards non-interest sources of income because they lack sufficient scale and requisite expertise in order to diversify away from traditional interest activities. Lepetit, Nys, Rous and Tarazi (2008) argue that larger banks tend to have more non-traditional activities. We, therefore, formulate hypothesis 3 to examine whether bank size has any significant influence on the impact of income diversification to enhance profitability.

However, the theoretical underpinnings against income diversification seem to suggest that hypothesis 3 might not hold. The implicit costs which are associated with

diversification can overshadow the benefits. Among the identified costs, Elsas, Hackethal and Holzhäuser (2010) cite agency problems related to diversifying investments, inefficient resource allocation problem due to malfunctioning of internal capital markets, asymmetric informational problem due to miscommunication between head office and divisional managers and the reckless rent-seeking attitude of managers. The agency problem arises when managers pursue growth through diversification by taking excessive risk, in excess of what is required by shareholders (Goddard, McKillop and Wilson, 2008). It is worth mentioning that a large portion of the Indian banking sector is controlled by the Government of India, where the principal-agent problem is eminent. Therefore, diversification can have a negative impact on profitability. In addition, Stiroh and Rumble (2006) argue that if commercial banks have an investment banking window and some fee-based income stems from investment banking activities, those earnings are more volatile than traditional lending activities, and thus banks with a higher portion of non-traditional income streams would be less profitable. DeYoung and Roland (2001) argue that it is less costly for the bank-clients of non-traditional fee-based activities to switch banks compared to bank-clients of traditional financial activities because in the latter case switching a bank requires establishing a new relationship with a bank, and it turns out to be costly for customers. The empirical studies that find a negative impact of diversification on profitability are by DeYoung and Roland (2001), Stiroh (2004) and Stiroh and Rumble (2006) for US financial holding companies. Acharya, Hasan and Saunders (2006) find that diversification of loans does not typically enhance profitability or reduce risk in Italian banks.

Pennathur, Subrahmanyam and Vishwasrao (2012) find that ownership types have a definite impact on non-interest income for Indian banks. They mention that bank size and management quality are deemed to be significant forces for banking profitability. They also argue that the pursuit of non-interest sources of income is risky for Indian banks due

to lack of prior experience, limited financial networks and unsophisticated technological infrastructure, especially at the small public and private sector domestic banks. However, with the RBI's indication of enhancing non-interest sources of income, state-owned banks are no less cogent than private domestic or foreign banks on fee-based income (RBI, 2003). It has been acknowledged in the recent papers (e.g., Das and Ghosh, 2009; Tabak and Tecles, 2010) that the state-owned banks are more efficient by highlighting that these banks undertake most of the government sponsored programs, such as personal provident fund collection, tax collection, etc., which are likely to generate substantial fee-based income. Therefore, we develop hypothesis 4 to test whether the impact of income diversification on profitability differs across ownership types.

The existing empirical literature on the impact of income diversification on profitability is heavily concentrated on US and European banking markets, while little attention has been paid to emerging markets especially India. Comprehending the significant effect of income diversification on profitability and how this effect differs depending on bank size or ownership types has immense importance to regulators for both Indian and other emerging Asian countries in order to maintain the desired level of bank stability.

2.4 The Model Specification and Variable Selection

2.4.1 The Benchmark Model Specification

To identify the determinants of bank profitability, we develop a panel data model that considers the potential influence of market structure in accordance with the existing empirical model. Following Smirlock (1985) and Lloyd-Williams, Molyneux and Thornton (1994), we can take both market structure variables i.e., concentration (HHI) and market share (MS) into the profit equation at the same time to discriminate between the SCP and RMP hypotheses. The extended profit equation is as follows:

$$\prod_{it} = \alpha_0 + \alpha_1 HHI_t + \alpha_2 MS_{it} + \sum_{j=1}^{J} \beta_j X_{i,it} + \sum_{k=1}^{K} \delta_k M_{k,it} + \sum_{l=1}^{L} \gamma_l D_{l,i} + \varepsilon_{it} \quad (2.1)$$

$$\varepsilon_{it} = v_i + u_{it}$$

In which $\prod$ is a profit measure of bank performance. Here i denotes bank and t stands for time. ε_{it} , is the disturbance, which consists of two components where v_i is the bank-specific unobserved heterogeneity and u_{it} is the idiosyncratic error term. This is a one-way error component regression model, where $v_i \approx IIN\ (0, \sigma_v^2)$ and is independent of $u_{it} \approx IIN\ (0, \sigma_u^2)$. X represents a vector of bank-specific variables varying across banks and over time, M is a vector of contemporaneous macroeconomic variables varying over time. Finally, D is a vector of dummy variables varying across banks.

2.4.2 Dependent variables and determinants of profitability

This section describes the dependent variables and the determinants of bank profitability. Since determinants of bank profitability are a function of internal and external factors we classify them into three clusters namely bank-specific, market/industry-specific and macroeconomic factors.

2.4.2.1 Dependent variables

In most of the earlier studies (e.g., Smirlock, 1985; Evanoff and Fortier, 1988; Berger and Hannan, 1989) price of a single banking product was employed as the measure of performance. Since, a bank is a multi-product service industry, prices of certain individual products or services are not a good measure for bank performance because cross subsidization among the products and services is more common than in other single product industries (Lloyd-Williams, Molyneux and Thornton, 1994). Bell and Murphy (1969) state two basic shortcomings for those studies which employed prices as the performance measure: (i) the costs of production of the particular banking service have not been considered (ii) may underestimate the total impact of the monopoly power on bank

performance by using a vague definition of bank output. Rhoades (1981) argues that, according to the theoretical model, market structure will influence the margin between prices and costs. So the margin will be accounted for in a profit measure but not in the price (interest rates) measure unless costs are explicitly accounted for. In addition, Gilbert (1984) argues that using average rates and average service charge rates are the poor measures of bank performance. Molyneux and Forbes (1995) also suggest using profitability measure because the profits and losses of all products are consolidated into one figure. It avoids the problem of cross subsidisation (Evanoff and Fortier, 1988).

Considering the multi-product nature of the banking business, using a single price of a product as the measure of bank performance would be misleading, as profit measures would be more informative. Therefore, we use two different measures of bank performances: return on assets (ROA) and return on equity (ROE). ROA is the ratio of net income over average total assets and ROE is the ratio of net income over average equity. We consider ROE as the main profitability variable, as it provides a comprehensive picture of profitability and is of greatest interest to the shareholders. ROA may be biased to off-balance-sheet activities. However, we report results from both measures.

2.4.2.2 Bank-specific variables

The main sources of bank-specific risk that may have a significant impact on banking profitability are through credit risk, solvency risk and liquidity risk. To understand the determinants of bank profitability, we have used seven bank-specific variables which have been documented as instrumental in explaining banking profitability. Firstly, an empirical analysis of banking profitability should control for the size-induced difference of banks. Different sized banks may have different abilities to reap economies of scale or scope. It is argued that large banks may exert market power and hence generate greater profit. They also have highly diversified product and loan portfolios compared to their

smaller counterparts, which might provide certain leeway in reducing risks. Therefore, we used logarithm of total assets (Size) as an indirect proxy for scale-efficiency and expected a positive relationship with profitability. Numerous studies have found a significant positive impact of size on profitability (e.g., Goddard, Molyneux and Wilson, 2004; García-Herrero, Gavilá and Santabárbara, 2009; Chortareas, Garza-Garcia and Girardone, 2011). However, extremely large banks may suffer from diseconomies of scale due to agency costs, the nitty gritty of administrative procedures and excessive overhead expenses.

The second variable is credit risk (i.e., NPL). It is included to account for the credit risk of individual banks, where NPL is the ratio of net non-performing loans to net total loans. Hesse and Poghosyan (2009) suggest that NPLs over net total loans provide better reflection of credit risk for banks. Since NPLs are costly to banks, a negative relationship is expected with profitability. Third, income diversification (Div) is measured as total non-interest income over total income (cf. Stiroh and Rumble, 2006). We expect a positive relationship between diversification and bank profitability. Fourthly, capital adequacy (measured by the ratio of equity capital to total assets, i.e., EqA) is considered to be one of the important factors affecting bank profitability. Banks with higher capital are capable of absorbing any negative shocks and are assumed to possess less insolvency risk. Since higher capital ratio may have possibility of lower bankruptcy and hence greater opportunity for banks to realise lower funding costs and higher incentives of monitoring management activities by shareholders, it is expected that capitalisation is positively related to profitability.

The fifth variable is liquidity risk (i.e., LTA). Banks lacking in liquidity struggle to meet their obligations towards creditors which can ultimately lead to bankruptcy. Following previous studies (e.g., Chortareas, Garza-Garcia and Girardone, 2011; Garza-

Garcia, 2012), we use the ratio of bank total loans to total assets (LTA) to proxy for the liquidity risk. The higher the LTA the more aggressive a bank should be towards profitability due to a substantially greater portion of interest bearing assets (Claeys and Vander Vennet, 2008; Hesse and Poghosyan, 2009). However, García-Herrero, Gavilá and Santabárbara (2009) argue that a greater amount of loans is associated with higher operational costs in originating, servicing and monitoring. Since literature has found mixed evidence on the expected sign of liquidity, we therefore expect an ambiguous relationship.

The sixth variable is related to operational inefficiency of individual banks represented by the ratio of operating expenses to total assets (i.e., OPT). It provides the snapshots of efficient costs management of banks. Higher ratio is related to higher expenses and will have a negative impact on profitability (Athanasoglou, Brissimis and Delis, 2008). Following Mirzaei, Moore and Liu (2013), we use OPT as a proxy for cost efficiency. We expect a negative relationship between OPT and profitability. The final bank-specific variable is the annual growth rate of total assets (GTA). It is included on the basis of the argument that rapid business growth through growth in assets is likely to be instrumental for bank profitability.

2.4.2.3 Market-specific variables

Similar to bank-specific variables, bank profitability is also affected by market structure or industry-specific variables. According to the industrial organisation literature, we have used market concentration (HHI) and market share (MS) variables in the profit equation and both are measured based on the lending market of Indian commercial banks. While HHI provides measures of how much the largest banks contribute to activity in a banking industry, MS shows the market power of an individual bank. However, the traditional SCP hypothesis would apply to the data if $\alpha_1 > 0$ and $\alpha_2 = 0$ which implies that

the market share does not affect a bank's profitability and that profitability is the result of monopoly behavior measured by concentration. The RMP hypothesis holds if $\alpha_1 = 0$ and $\alpha_2 > 0$ which implies that banks with a large market share are more efficient than their rivals and thus earn higher profits. In that circumstance, market concentration does not affect bank profitability.

Regarding ownership structure, we have included two dummy variables for public-owned banks (i.e., public) and foreign-owned private banks (i.e., foreign) in our study. A further dummy (i.e., Old Bank) is added to examine whether banks established before liberalisation (1992) are more profitable than the banks established after liberalisation. There were 26 public commercial banks in India as of 2010-11; with the view to examining whether the percentage share of government ownership in those public banks makes a difference to the profitability, we add another industry-specific variable (i.e., %Govt.) to equation (2.1). Detailed definitions of the variables included in this study are provided in table 2.1.

2.4.2.4 Macroeconomic variables

Since the banking industry is highly regulated and the environment in which they operate has significant influence on the performance of banks, an incomprehensive account of those variables in the profit equation would provide biased results. Therefore, acknowledging macroeconomic determinants in the profit equation would solve the problem of omitted variable bias in the regression.

Three macroeconomic indicators are used to check whether there is any correlation between the profitability of banks and macroeconomic state of the economy. The most important macroeconomic indicator is inflation (INF). INF is included to control for economic uncertainty in the banking industry. It was reported in the previous studies that

high inflationary environment is congenial for greater margins and bank returns (Bourke, 1989). However, we expect an ambiguous relationship between inflation and profitability because banks can earn higher returns from an inflationary environment only when managers can anticipate inflation accurately and adjust interest rates on loans and deposits. The second macroeconomic variable is the real interest rate (INT). Since interest rate volatility can foster bank profits we expect a positive relationship between interest rate and profitability. Finally, we include real GDP growth rate in the profit equation. A positive relationship is expected between GDP and profitability. However, a high GDP growth rate can have a negative impact on profitability if competition effect persists and deposits supply dwindles because of greater consumption along with GDP growth. To examine the determinants of bank profitability we use the following extended model:

$$\begin{aligned}\prod_{it} &= \alpha_0 + \alpha_1 HHI_t + \alpha_2 MS_{it} \\ &+ \beta_1 Size_{it} + \beta_2 NPL_{it} + \beta_3 EqA_{it} + \beta_4 LTA_{it} + \beta_5 OPT_{it} + \beta_6 Div_{it} + \beta_7 GTA_{it} \\ &+ \delta_1 INF_t + \delta_2 INT_t + \delta_3 GDP_t \\ &+ \gamma_1 Public_i + \gamma_2 Foreign_i + \gamma_3 Old\ Bank_i + \gamma_4 \%Govt._i + \varepsilon_{it}\end{aligned} \tag{2.2}$$

2.4.3 Bank size, credit risk and income diversification

The perceived advantages (e.g., economies of scale and scope, market power and so on) that are inherently associated with large banks are likely to impact on their prudential parameter (e.g., NPL) and their diversified profit maximization capacity (e.g., non-interest sources of income), which eventually reflect on profitability. Therefore, with a view to examining whether bank size heterogeneity has any significant influence on the impact of credit risk or income diversification, we use the following empirical specification:

$$\prod_{it} = \alpha_0 + \alpha_1 HHI_t + \alpha_2 MS_{it} + \beta_1 Credit\ Risk_{it} + \beta_2 Size_{it} + \beta_3 Credit\ Risk_{it} * Size_{it} + \beta_4 Diversification_{it} + \beta_5 Diversification_{it} * Size_{it} + \sum_{j=6}^{J} \beta_j X_{i,it} + \sum_{k=1}^{K} \delta_k M_{k,it} + \varepsilon_{it} \quad (2.3)$$

where NPL, Size and DIV are the proxy for credit risk, natural logarithm of total assets and income diversification of individual banks over time, respectively. The interactions of credit risk and bank size as well as income diversification and bank size are included to examine whether bank size has any influence on the impact of credit risk and income diversification. We use the analogous explanatory variable as in equation (2.1) to control for the various characteristics of banking operations that may have a differing effect on profitability for small and large banks.[14]

2.4.4 Ownership, credit risk and income diversification

To disentangle whether the relationship between credit risk or diversification and profitability varies across different ownership types (public, private domestic and foreign banks), we interact each ownership dummy with credit risk and diversification. In this case, since fixed effect estimation does not allow testing for the differences in banking ownership groups, we run the regressions by using a random effects estimator.

2.5 Data description and analysis

This section describes the sources of data used in our study. To get a homogenous sample we focus on only the commercial banks in India for the period 2004 to 2011.[15] The main source of data on the bank's balance sheets, income statements and annual reports is from the Reserve Bank of India. Our dataset is considered to be superior to the BankScope

[14] The vector of dummies is not included.
[15] For India, financial year starts from 1 April and ends on 31 March of every year. Therefore, 2004 denotes the 2003-2004 financial year and so on.

database; however, for the sake of accuracy, we have cross-checked them with the data obtained from BankScope.[16] Regarding foreign commercial banks' data we had to depend exclusively on the income statements and balance sheets collected from RBI since BankScope does not provide any data regarding foreign banks operating in India. Since we have eliminated observations with missing data for the variables, we have therefore an unbalanced panel dataset. It should be noted that we have applied rules to eliminate outliers based on the 1st and 99th percentiles of the distributions of the dependent variable in the profit equation. The sample includes 73 commercial banks operating in the Indian banking industry. This accounts for the Indian banks holding more than 95% of total assets. We augment our RBI dataset with the country level macroeconomic indicators retrieved from the World Bank database.[17] Descriptive statistics and the correlation coefficients of independent variables are now discussed.

Table 2.2 shows the descriptive statistics of basic variables used in the estimation of profit equations. The descriptive statistics provide very interesting insights. The return on equity (ROE) varies between -46.9% and 38.3% with an average of 13.5%, while the return on assets (ROA) varies between -2.1% and 6.71% with an average of 1.3%. In both profitability measures the minimum values are negative. The probable explanation is that during the 2004-05 fiscal years the profitability of many banks had shrunk drastically due to the rising interest rate environment in India. The average of CR5 (40.71%) and HHI (582) indicate that the Indian banking industry is moderately concentrated[18]. The maximum value (18.6%) of market share (MS) indicates weak evidence of market competition in India. The logarithm of total assets varies between 5.71 and 16.32 reflecting the massive heterogeneity of bank sizes in the industry. The credit risk (NPL) varies

[16] BankScope is maintained by Fitch/IBCA/Bureau Van Dijk.
[17] http://data.worldbank.org/indicator
[18] HHI is multiplied by 10,000.

between 0% and 76%, with mean of 2% and standard deviation of 6.07%. The average NPL ratio over the years shows a minimum of 0.78% in 2008 and maximum of 5.35% in 2004. It shows that some banks suffer from the huge burden of bad assets. The income diversification (DIV) varies between -12.66% and 83.22%, with mean of 19.13% and standard deviation of 14.25%. The mean value suggests that one-fifth of the total income was generated from non-interest income sources. The capitalisation (EqA) varies between 1.0% and 98.1% with a mean of 13.5% indicating the healthy status of the Indian banking industry. However, there are some banks (e.g., SCBs) still under-capitalised compared with the international competitive norm. The operational inefficiency varies between 0.32% and 10.6%. The ratio of loans to total assets varies between 0% and 75.8%, while growth rate of total assets varies between 76.9% and 917.5%. Finally, for the macroeconomic indicators, the inflation (INF) rate varies between 3.8% and 12%, the real interest rate (INT) varies between -0.5% and 6.87%. The mean value GDP growth rate is 8%, however it reached almost 11% in 2006-07 followed by 4% in 2007-08 because of the global financial crisis.

Panels A and B of Table 2.3 show the comparative study on mean values of the dependent and some selected explanatory variables in terms of bank-size groups and ownership types, respectively.[19] We find wider variations comparing the statistics across bank-size groups. Panel A shows that large banks (17.1%) have almost three times higher ROE than small banks (6.5%). Regarding credit risk, small banks have the highest average credit risk (3.7%), followed by medium-sized banks (1.6%) and large banks (1.1%). On the other hand, small banks (25.5%) have the highest non-interest income, followed by medium-sized banks (18%) and large banks (15%). The mean comparison tests show that

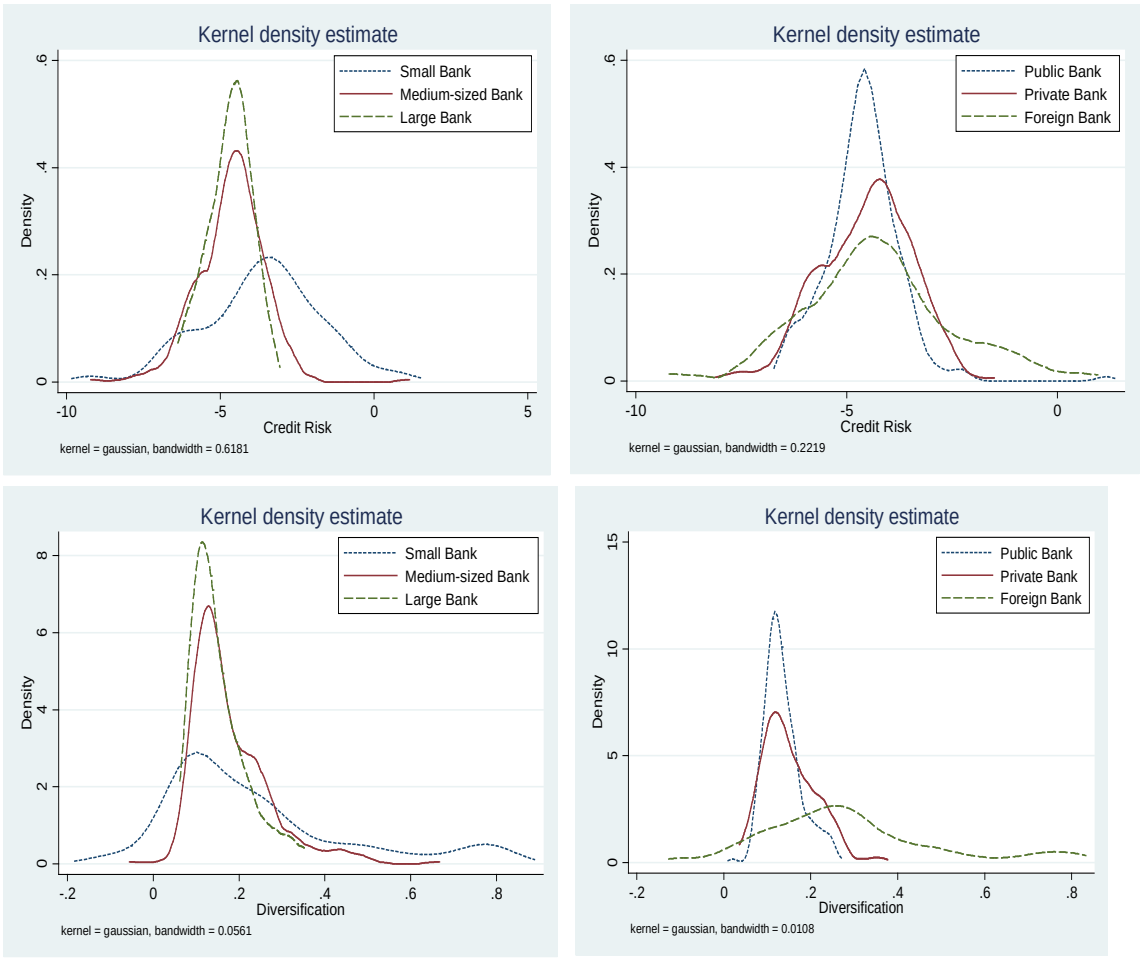
[19] Based on total assets, three size classes have been considered. These are: small banks: assets up to Rs. 35 billion, medium-sized banks: assets between Rs. 35 billion to Rs. 685 billion, large banks: assets above Rs. 685 billion.

the credit risk is significantly different between small and medium banks and between small and large banks. Overall, the results suggest that bank size heterogeneity does matter in the management of credit risk and in the pursuit of non-interest income.

We also find wider variations comparing statistics across ownership types. Panel B shows that private foreign banks have the highest average credit risk (2.8%), followed by public banks (1.7%) and private domestic banks (1.6%). Regarding non-interest income, the differences between public and private foreign banks are enormous. Private foreign banks (29%) earn almost twice as much as public (13.5%) and private domestic banks (15.1%) from non-interest sources of income. Private foreign banks in India face enormous restrictions on licensing/ branching and acquisition activities by RBI. Since foreign banks have prior experience, and better financial networks, they reasonably emphasise non-interest sources of income to render advisory services to the ever growing corporate sector (Pennathur, Subrahmanyam and Vishwasrao, 2012). The comparison tests of the means of all three ownership types are significantly different. Therefore, the overall results suggest that ownership does matter for maintaining credit risk and in the pursuit of non-interest income.

Figure 2.3 shows the Kernel density plots (based on Gaussian kernel) of credit risk and income diversification for all three banking size groups and ownership types. The upper panel shows an asymmetric distribution for all size-groups and ownership types, indicating small banks and the private foreign banks have the highest credit risk. Similarly, the lower panel of Figure 2.3 shows the kernel density plots of income diversification. It reveals an asymmetric distribution for all size-groups and ownership types, indicating small banks and private foreign banks have the most diversified portfolios.

Figure 2.3
Kernel density estimates (KDE) for Credit Risk and Income Diversification by bank size groups and ownership types.



Note: Based on total assets, three size classes have been considered. These are: small banks: assets up to Rs. 35 billion, medium-sized banks: assets between Rs. 35 billion to Rs. 685 billion, large banks: assets above Rs. 685 billion. Since credit risk ratio is limited by zero, we applied a logistical transformation to create kernel density plot. Kernel density plots on the upper panel show the credit risk, while plots on the lower panel show the income diversification for all size groups and ownership types.

The correlation matrix between independent variables is presented in table 2.4. It suggests that the variables used in our study do not possess a serious multicollinearity problem. Gujarati (2003) explains that a serious multicollinearity problem will arise if the pair-wise correlation coefficient between two regresses exceeds 0.8.[20]

2.6 Regression Results

In this section first we present the estimation results of the profitability of the Indian

[20] Variance Inflation Factor (VIF) is also calculated to check for multicollinearity between independent variables; VIF shows that all variables are less than the critical value of 10, suggesting no serious multicollinearity problem. The mean VIF is 2.43.

banking industry. Then, we show the empirical results of the influence of bank size and ownership on the impact of credit risk and diversification. Finally, we report an array of robustness tests.

We estimate equation (2.1) to find out the determinants of profitability. In doing so, we also examine the impact of market structure (i.e. HHI and MS) on the profitability of the Indian banking industry. Since we have augmented this model with macroeconomic and dummy variables we run the regressions in three steps to identify the stability of the sign and significance. In the first step, we run regression only with market structure and bank-specific variables. In the second step, we report the estimates of all bank-specific, market-specific and macroeconomic determinants. In the final step, we add a vector of dummy variables in the profit equation to examine whether ownership structure, the percentage share of government ownership at public banks, and bank age have any significant impact on profitability.

The estimation technique used in this study is panel data methods.[21] Hausman tests were carried out to choose between fixed effects (FE) and random effects (RE) estimators.[22] We run the estimators by clustering banks to get heteroskedasticity and autocorrelation corrected robust standard errors.[23] All the diagnostic statistics are reported at the bottom of each table. The explanatory power of the model is reasonable. The F-statistic or Wald-test (e.g., RE models) for all models is significant at the 1% level.

[21] Numerous advantages are associated with panel data methods. The usage of this method increase the number of data points and hence increases the degrees of freedom. It can reduce the omitted variables problem substantially by using information relating to both cross-section and time-series.

[22] The null hypothesis of the Hausman test is that the difference in coefficients is not systematic, and rejecting the null suggests that FE is better than the RE estimator.

[23] In general, the endogeneity problem is a matter of concern for panel regressions. However, this problem can be eliminated by using the Generalised Methods of Moments (GMM) where it uses instrumental variables. Since, instrument variables have one or two periods lagged values, using them would result in losses of degrees of freedom. The dataset of our study is unbalanced and with annual frequency of observations; therefore, using instrumental variables would provide poor empirical performance. By using the static panel estimators, we have got relatively good results with satisfactory diagnostic statistics. However, an array of robustness tests is performed to check the sensitivity of the results. For details please see Stata user's guide.

2.6.1 The determinants of bank profitability

Table 2.5 reports the empirical results for a bank's return on equity for the Indian banking industry through the first three models (i.e. 1, 2 and 3). It also reports the results for a bank's return on assets for India through the last three models (i.e. 4, 5 and 6). Since bank ownership does not change over time, we use year dummies (i.e. time trend) in all regressions.

Models 1-3 of table 2.5 show that concentration (HHI) coefficients are always positive and significantly related to return on equity at the conventional statistical level, whereas the coefficients of market share are always negative and insignificant. This indicates that market concentration dominates the market share for the Indian banking industry, supporting the traditional interpretation of the structure-conduct-performance (SCP) hypothesis and rejecting the relative-market-power (RMP) hypothesis. We find similar results when return on assets is used as the dependent variable. These findings suggest that profitability for the Indian banking sector is determined by the concentration not by the market share of banks. It should be noted that the five largest banks of India have almost half of the market share of the Indian banking industry. These findings accord with much of the existing literature on emerging markets, which finds a positive and statistically significant relationship between market concentration and banking profitability (e.g., Al-Muharrami and Matthews, 2009; Bhatti and Hussain, 2010; Sufian, 2010; Ahamed, 2012).

Interpreting the bank-specific variable, we find that all of the coefficients are significant in models at least at the conventional statistical significance level except for the liquidity risk and growth rate of total assets. The coefficient of bank size (i.e. logarithm of total assets) is always positive and statistically significant, implying the existence of economies of scale in the Indian banking sector. This is an indication that size-induced

differences between banks lead to higher returns because larger banks operate at the most efficient scale (i.e., increasing return portion of their average cost curve). The scale efficiencies of larger banks also resonate with the positive impact of concentration on profitability in the banking sector. The empirical literature on optimal bank size is conflicting. However, a large number of studies find similar results to ours that larger banks enjoy economies of scale and scope whereas smaller banks suffer from diseconomies of scale and scope (e.g., Mirzaei, Moore and Liu, 2013).[24]

We find a negative and statistically significant relationship between credit risk and profitability. Since nonperforming loans are costly to the banks and a higher accumulation of unpaid loans renders lower profits, the negative relationship between credit risk and profitability is consistent with *a priori* expectations. Based on model 1, we find that a 1% decrease in net NPLs leads to a 0.12% increase in return on equity. However, the detailed explanations on the influence of bank size and ownership on the impact of credit risk are discussed in sub-sections 2.6.2 and 2.6.3, respectively.

The income diversification (DIV), measured as non-interest income to total income, appears to be instrumental for the profitability of the Indian banking sector.[25] The positive relationship between diversification and profitability is consistent with *a priori* expectations, and significant for all models at the 1% level, implies that banks with higher non-interest sources of income are more profitable. This result is consistent with Baele, De Jonghe and Vander Vennet (2007) and Chiorazzo, Milani and Salvini (2008). Similar to credit risk, the detailed explanations on the influence of bank size and ownership in the impact of diversification are also discussed in sub-sections 2.6.2 and 2.6.3, respectively.

[24] According to the total assets size of individual banks, we created a dummy for the large bank group and ran regression on the entire sample. We find that large banks are statistically significant at the 1% level and positively related with return on equity (not with return on assets). It confirms that bank size has a significant impact on profitability.

[25] We run a Durbin–Wu–Hausman test to check for endogeneity of the independent variable income diversification; the result obtained suggests that there is no endogeneity between profitability and diversification.

Capitalisation (EQA) is one of the most important bank-specific factors with a significant impact on the profitability of Indian banks. The capitalisation is negative and significant with return on equity. It reflects the expected theoretical relationship between risk and return, that is banks with a high-level of equity capital (i.e., low bankruptcy risk) lose potential profitable trading opportunities, and thereby earn lower profits (e.g., Berger, 1995b; Goddard, Molyneux and Wilson, 2004). However, it is positive and statistically significant with return on assets, indicating the soundness of Indian banks. A bank with higher equity capital can reduce bankruptcy costs, and hence earn higher profits through charging higher interest on loans and/or paying less on deposits (Ben Naceur and Goaied, 2008). The shareholders' intense monitoring of bank managers' activities can have a significant impetus on profitability as well. Recent studies that find a significant positive relationship between capitalisation and return on assets include Demirgüç-Kunt and Huizinga (1999), Chortareas, Garza-Garcia and Girardone (2011), Garza-Garcia (2012) and Berger and Bouwman (2013).

The liquidity risk (LTA), measured as the ratio of total loans over total assets, does not have a significant impact on profitability. However, the negative coefficient suggests that greater composition of assets in the form of loans may have a negative impact on returns. It is also consistent with *a priori* expectations and in line with the findings of Garza-Garcia (2012). The negative impact on profitability may be due to the high operating costs associated with servicing and monitoring a large number of loans.

The operational inefficiency measure (OPT) is negative and significant for models 1-4. The negative relationship between OPT and profitability is consistent with *a priori* expectations and in line with the findings of Athanasoglou, Brissimis and Delis (2008). The negative coefficient suggests the existence of the *X*-efficiency hypothesis in which banks with efficient management are able to cut their operating expenses, and thereby increase profitability. The growth rate of total assets (GTA) does not have any significant

impact on profitability. However, the positive coefficient indicates that banks with higher growth rate in terms of total assets earn greater returns.

Explaining macroeconomic variables, we find inflation (INF) is always negative and statistically significant with profitability. This relationship indicates that bank managers were unable to anticipate inflation accurately over the sample period and act accordingly to adjust interest rates, resulting in faster increase of costs rather than revenues. The real interest rate (INT) is negative and significantly related with return on equity. The probable explanation for the negative coefficient is that real interest rate in India has risen significantly over the study period, which may have provided stringent economic conditions for the banking sector. Since banks transfer the interest rate risk to consumers, a high real interest rate may have reduced the amount of credit and financial services and, therefore they were unable to reap higher returns. This result contrasts with Bourke (1989), who finds a positive relationship between interest rate and profitability. However, the negative relationship is an indication that banks can be more profitable if they pursue non-interest sources of income in conjunction with their interest income. The final macroeconomic factor is the real GDP growth rate. We find a robust link between GDP and bank profitability. It does not conform to *a priori* expectations that higher growth rate results in higher returns for banks. However, we find a negative relationship between them. The increasing competition in the banking sector may have contributed to this inverse relationship. It is reasonable to understand that during a boom period banks tend to compete with each other fiercely for the deposits and loans as well as for other non-interest income, and thus respond in an anti-cyclical manner.

Models 3 and 6 show the estimation results of the dummy variables used in this study. The coefficient of the dummy variable of public banks is positive and statistically significant with return on equity. The dummy variable for foreign-owned banks does not have a statistically significant relationship with profitability but it is negatively related. The

possible explanation is that private foreign banks are slightly in a disadvantaged position in India due to lacking cultural, political and language knowledge. Since public sector banks are not wholly owned by public we add the percentage of government ownership at public banks to examine the impact of the level of government ownership on profitability. In doing so, we find a significant negative relationship with returns on equity at the 1% level. This strong negative relationship suggests that public banks with a higher level of government ownership earn significantly lower profits. The coefficient of old banks (i.e., any banks established before liberalisation in 1992) is positive and significant with return on assets, indicating that old banks in India earn higher returns than any bank that entered into the banking sector after the liberalization process began.

2.6.2 Credit risk and income diversification: The influence of bank size

Table 2.6a reports the estimation results of the influence of bank size on the impact of credit risk or income diversification on profitability. In these regressions the main concern is the coefficients of the interaction terms and their marginal effect.

Prior to describing the impact of credit risk or income diversification, it should be noted that, in the case of multiplicative terms in the models, based on simple t-statistics we cannot make accurate inference because model parameters do not provide adequate information (Brambor, Clark and Golder, 2006). Merely looking at the results without following correct procedures in the case of interaction terms would mislead the inference. Following Brambor, Clark and Golder (2006), we use marginal effect to show the influence of bank size on the impact of credit risk or income diversification[26]. A 'Size Index' is created based on the 10^{th}, 25^{th}, 50^{th}, 75^{th}, 90^{th}, 95^{th} percentiles and mean values of bank

[26] One may assume that the multicollinearity problem may arise if all constitutive terms are used in an interaction model. Brambor, Clark and Golder (2006) however state that multicollinearity may provide large standard errors but they are the correct standard errors.

size.

The coefficient of the interaction between credit risk and size is positive and insignificant. However, the positive sign implies that large banks are better able to manage their credit risk and earn higher profits. For a more precise analysis, we have calculated the marginal effect and standard errors of credit risk on profitability for different sizes of banks. From the marginal effects it can be envisaged that smaller banks (at 10^{th} and 25^{th} percentile in the Size Index) are vulnerable to higher credit risk and, hence earn less profit (Table 2.6b). The probable explanation is that the under-developed small banks tend to invest in risky projects or channel funds to lower quality borrowers. In addition, small banks have limited resources and limited ability to screen and monitor borrowers adequately in order to stem accumulating bad loans. It supports hypothesis 2 that the negative impact of credit risk on profitability in the form of NPLs varies with bank size.

The result also corroborates with the use of marginal effect graphs. Figure 2.3 shows the impact of credit risk or income diversification on profitability conditional on bank size. The graphs in the upper panel display the marginal effect of credit risk (i.e., thick solid line) at different levels of bank size on return on equity (left) or return on assets (right). It also confirms that the negative impact of credit risk diminishes as bank size increases. This in turn suggests that if the bank size is sufficiently high, then the marginal effect of credit risk may stop being negative and become positive. However, we have drawn two-tailed 95% confidence intervals around the marginal effect; the effect of credit risk is significant whenever the upper and lower bounds of the confidence intervals are both above (or below) the zero line. Therefore, it can be gleaned from Figure 2.3 that credit risk stops having a statistically significant effect on ROE and ROA once the bank size exceeds about Rs. 31.9 and 75.9 billion, respectively.

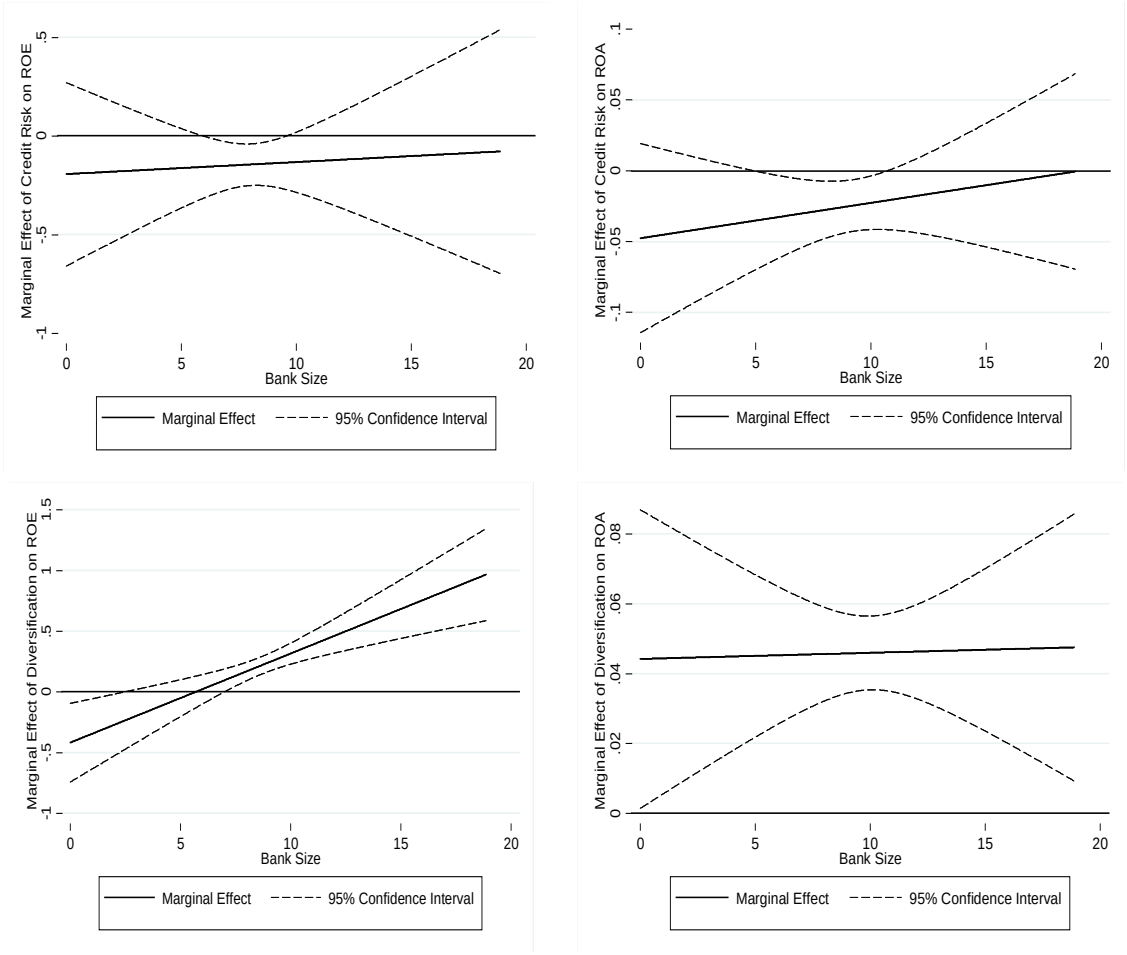
On the other hand, the coefficient of interaction between income diversification and bank size is positive and statistically significant at the 1% level. It suggests that large

banks are better able to diversify their income towards non-interest sources and earn higher profits than their smaller counterparts, supporting hypothesis 4 that the positive impact of income diversification on profitability in the form of non-interest income differs with bank size. The marginal effect and standard error are reported in table 6b. It suggests the impact of income diversification on bank profitability is conditional on bank size. As bank size increases, the positive impact of income diversification increases. These findings have reasonable economic interpretations. Since diversification acts as an inflator for the bank's profitability, reasonable income stemming from non-interest sources would be ideal for Indian banks to maintain stability and fight against negative shocks. It is evident from this empirical estimation that larger banks with non-interest sources of income enjoy greater performance benefits than the smaller banks in the market. These favourable impacts increase as bank size increases. Though small banks have the highest diversified income from non-interest sources (recall table 2.3), overall it appears that larger banks achieve more favorable diversification benefits in the Indian banking industry. The probable reason could be the market power which allows them to enjoy cost synergies stemming from the economies of scale. It can be said that a bank with reasonable diversified income can water down any negative shocks better than a bank which has a trivial number of diversified portfolios. A well-diversified bank can increase returns substantially and hedge against risks.

The result is also verified in Figure 2.4. The graphs on the lower panel display the marginal effect of diversification at different levels of bank size on ROE (left) or ROA(right). It also confirms that the positive impact of diversification on profitability increases with bank size (in the case of ROA, we observe a marginal increase). These results also correspond with most of the previous studies on India, in which medium and large banks are found to be more efficient in terms of costs and profits (e.g., Das and

Ghosh, 2009; Bhattacharyya and Pal, 2013).

Figure 2.4
Marginal effect of credit risk or income diversification on bank profitability (e.g. return on equity and return on assets)



Note that it corresponds with our results in Tables 2.6a and 2.6b. The graphs on the upper panel display the marginal effect of credit risk at different levels of bank size on ROE (left) or ROA(right). It shows that the negative impact of credit risk diminishes as bank size increases. The thick line gives the marginal impact as estimated by $\partial \Pi / \partial npl = \overline{\beta_1} + \overline{\beta_3} * Size$, where Π is the banking profitability. The dotted lines represent the 95% confidence interval. The graphs on the lower panel display the marginal effect of income diversification at different levels of bank size on ROE (left) or ROA(right). It shows that the positive impact of diversification increases as bank size increases. The thick line gives the marginal impact as estimated by $\partial \Pi / \partial div = \overline{\beta_4} + \overline{\beta_5} * Size$.

2.6.3 Credit risk and income diversification: The influence of ownership

Table 2.7 presents the empirical estimations of the role of ownership on the impact of credit risk or diversification. It shows that the relationship between credit risk or diversification and profitability varies significantly across different bank ownership types. In this regression, we report the results of credit risk and diversification interacting with

the dummies for public, private and foreign banks.

While credit risk is negative and significantly associated with banking profitability for foreign commercial banks, it is insignificantly related to public and private commercial banks, supporting hypothesis 2. This implies that high NPLs results in lower profits for foreign banks, but not for public and private banks. This result corresponds with the mean comparison tests represented in Panel B of Table 2.3, where it shows that private foreign banks in India comparatively had the highest amount of NPLs (2.78%) for the sample period. The possible explanation is that due to having relatively larger size, economies of scale and domestic knowledge, the public and private domestic banks are better at managing credit risk effectively.

Regarding the influence of ownership on the impact of diversification, the banks of all three ownership types enjoy higher profitability as non-interest sources of income increase, with the effect being strongest for the public banks, supporting hypothesis 4. Though a substantial amount of income for private foreign banks stems from non-interest sources (i.e., 29.09%), after controlling for other variables, we find that public and private domestic banks benefited more from the income of non-traditional activities than the private foreign banks in India. The result implies that public and private domestic banks with a reasonable amount of non-interest sources of income alongside traditional banking activities can help overall profitability. This result also corresponds with most of the Indian studies that find public and private domestic banks are more efficient than private foreign banks with respect to costs and profit efficiency. Das and Ghosh (2009) state that medium-sized public banks have on average a low level of NPLs because of their high-level of technical efficiency. They also point out that state-owned banks generate a substantial amount of fee-based income from government sponsored programs, and thus become more efficient than their counterparts.

2.6.4 Robustness Checks

2.6.4.1 Attrition Effect

During the sample period, some banks drop out due to mergers and acquisitions. We have kept those banks which have presence for the entire sample period and re-estimated equation (2.1) in order to check whether attrition affects our results. After dropping banks, we have 70 banks in the sample. In this case, we have also used different specifications for the concentration index. Five-bank concentration ratio (CR5) is being used instead of HHI. The results are presented in the left four columns of table 2.8. The sign and significance of the coefficients of all bank-specific, market-specific and macroeconomic variables remain unchanged with the exception being the operating inefficiency and inflation.

2.6.4.2 Alternative cutoff

Since our dataset includes many small and large banks, to avoid the effect of 'too-big-to-fail' and 'too-small-to-survive' banks we use an alternative cutoff. To check the robustness a more stringent outlier adjustment was made. We deleted data at the 10^{th} and 90^{th} percentile of total assets and re-estimated equation (2.1). In this case also, we have CR5. The results of the robustness tests confirm that our base results are robust to the alternative measure of concentration and cutoff. The sign and significance of most of the variables remain unchanged with some interesting findings. The insignificant credit risk variable implies that medium-sized banks are not too exposed to NPLs nor have prudent credit risk management system in place, reiterating support for hypothesis 1. In general, small banks, especially foreign banks, are burdened with huge NPLs in India. The coefficient of income diversification is significant and greater than the earlier finding suggesting that medium-sized banks are more inclined to non-interest sources of income,

and thereby earn higher profits. In addition, the insignificant operating inefficiency variable indicates that medium-sized banks are more efficient, in tune with the finding of Das and Ghosh (2009).

2.7 Conclusion and policy implications

The multiple financial sector reforms in the 1990s have altered the organizational forms, the dynamics of competition and the way commercial banks operate in India. To live up to the competitive forces, banks have not only pursued improving operational efficiency by reducing bad assets and expenses but also diversified their income towards fee-based non-interest sources of income, which must have impacted the profitability.

This paper has investigated the effects of bank-specific, market-specific and macroeconomic determinants of profitability of the Indian banking industry for the period 2004-2011, assessing the outcome of reforms in a banking sector consisting of banks with heterogeneous sizes and mixed ownership groups. Thus, this paper has examined whether credit risk and income diversification interacts with bank size or ownership affecting bank profitability.

We find that market concentration has a positive impact on the performance of Indian banks, indicating large banks dominate the entire banking industry and earn higher than normal profits through non-competitive price settings. Regarding bank-specific factors, bank size appears to be positive and significant, suggesting large banks enjoy economies of scale and earn higher profits. The results also suggest that income diversification has a robust link with profitability, venturing into non-traditional activities, such as fee-based income in conjunction with traditional lending practices yielding higher returns for Indian banks. It appears that in order to be competitive and profitable, Indian banks have not only to improve their costs efficiency through reducing operating expenses but also to improve credit risk management through reducing NPLs, especially for the

private foreign banks which are saddled with, on average, a high level of operating expenses and NPLs (see Das and Ghosh, 2009). Meanwhile we find a negative relationship between capitalisation and profitability which is in line with the theoretical relationship between risk and returns: higher capital is a sign of banks being overcautious and ignoring potentially profitable trading opportunities, and thereby reaping lower profits (e.g., Goddard, Molyneux and Wilson, 2004).

Similar to other countries, bank profitability is strongly subject to cyclical developments. Given the negative relationship between GDP growth rate and profitability, anti-cyclical behaviour appears to be the case for Indian banks. Moreover, the estimation results show a significant negative influence of inflation and real interest rates on bank profitability. Regarding ownership structure, though Bhaumik and Dimova (2004) did not find evidence of a performance gap between ownership groups, our result seems to suggest that state-owned banks have had a positive impact on profitability. However, with respect to our second profitability measure we did not find any statistically significant relationship with ownership.

Our results on the issue of whether credit risk and income diversification interact with bank size affecting profitability, suggest that the negative impact of credit risk in the form of NPLs diminishes as bank size increases, and the significant negative impact disappears once bank size crosses a threshold point (i.e., Rs. 32/76 billion). Similarly, the interaction between income diversification and bank size suggests that large banks are better able to diversify their income towards non-interest sources and earn higher profits than their smaller counterparts. It appears that bank size does matter in the impact of credit risk and income diversification on profitability.

On the other hand, ownership also seems to have substantial influence on the impact of credit risk and income diversification. Our results show that credit risk is negative and significantly associated with bank profitability for foreign banks, but not for

state-owned and private domestic banks. Similarly, we find that banks of all three ownership types enjoy higher profitability as non-interest sources of income increase but the effect is stronger for the public banks. Overall, it suggests that ownership does matter in the impact of credit risk and income diversification on the profitability of Indian banks.

The results of this study have some policy implications for the Indian government, the central bank of Indian–RBI, regulatory authority and bank managers due to improved bank performance: (I) given the robust impact of market concentration while controlling for other variables, the regulators should take precautionary measures in order to allow further M&As in the market; (II) to increase competitive conditions, more banking licenses should be given to private domestic and foreign banks while also reducing government ownership in the banking sector by considerable dilution of capital in order for yielding a level-playing field for all; (III) bank managers should emphasise further improvement of asset quality and cost efficiency and undertake prudential measures to utilise equity capital that is well in excess of a regulatory minimum without impairing bank stability; (IV) bank managers can reap the diversification benefit if they pursue cautiously by considering their sizes, strengths, capabilities and risk level, and embarking on the areas they are good at; and (V) the robust link between macroeconomic indicators and banking profitability found in this study implies that regulators should pay considerable attention to create a congenial environment for a profitable and stable banking sector.

Table 2.1
Definitions, notations and expected effect of explanatory variables on profitability

Variable	Measure	Notation	Expected Effect	Source
Dependent variables				
Return-on-equity	Net Income / Equity	ROE	n/a	RBI
Return-on-assets	Net Income / Total Assets	ROA	n/a	RBI
Market Structure Specific				
Market Share	Market Power of Individual Bank	MS	-	RBI
Herfindahl-Hirschman Index	Squaring the market share of each bank and then summing the squares.	HHI	+	RBI
5-bank concentration	Market share of 5-largest banks	CR5	+	RBI
Bank-Specific				
Bank Size	Logarithm of Total Assets	Size	+	RBI
Credit Risk	Net non-performing Loans over Net Loans	NPL	-	RBI
Diversification	Non-interest Income/Total Income	DIV	+	RBI
Capitalisation	Equity / Total Assets	EQA	+	RBI
Liquidity Risk	Loans over Total Assets	LTA	?	RBI
Operating Inefficiency	Operating Expenses/Total Assets	OPT	-	RBI
Growth of Assets	Annual Growth Rate of Assets	GTA	+	RBI
Industry/Market-specific				
Public bank Dummy	Equal to 1 for public-owned banks otherwise 0	Public	?	RBI
Private Bank Dummy	Equal to 1 for public-owned banks otherwise 0	Private	?	RBI
Foreign Bank Dummy	Equal to 1 for foreign-owned banks otherwise 0	Foreign	?	RBI
Old Bank	Equal to 1 if bank established before liberalisation (1991)	Old	+	BankSco
% of Government	The % of Government ownership in public banks	%Govt.	-	BankSco
Macroeconomic				
Real GDP	Annual Real GDP Growth Rate	GDP	?	World
Inflation	Consumer Price Index	CPI	?	World
Real Interest	Annual Real Interest Rate	INT	?	World

Note: The expected relationship between profitability and explanatory variable is indicated by Positive and Negative signs. '?' indicates that the relationship is ambiguous (Positive or, Negative) with profitability. The Reserve Bank of India is denoted by RBI.

Table 2.2

Descriptive Statistics of Indian Banking Industry (2004-2011)

	N	Mean	Std. Dev.	Min	Max
Dependent Variables					
Return on equity (ROE)	568	13.5	9	-46.9	38.32
Return on assets (ROA)	568	1.26	1.04	-2.1	6.71
Market-specific Variables					
Concentration (HHI)	568	582	12	562	602
Concentration (CR5)	568	40.71	1.39	38.61	42.57
Market Share (MS)	568	1.41	2.5	0	18.64
Bank-specific Variables					
Bank Size (Log. total assets)	568	11.77	2.24	5.71	16.32
Credit Risk (NPL)	568	2	6.07	0	76
Diversification (DIV)	568	19.13	14.25	-12.66	83.22
Capitalisation (EQA)	568	13.53	15.27	1.01	98.05
Liquidity (LTA)	568	48.52	15.97	0	75.77
Operational inefficiency (OPT)	568	2.31	1.23	0.32	10.6
Growth Rate (Total assets)	568	26.04	64.28	-76.89	917.47
Macroeconomic Variables					
Inflation	568	7.62	2.77	3.77	11.99
Real Interest Rate (INT)	568	4.19	2.31	-0.48	6.87
GDP Growth Rate	568	8.18	2.03	3.89	10.55

Note: HHI and CR5 denote the Herfindahl-Hirschman Index and 5-largest bank concentration ratio, respectively. HHI is multiplied by 10,000. All variables are expressed in percentages except Bank Size and HHI.

Table 2.3

Profitability, Bank Size, Credit Risk and Diversification by Bank-size Groups and Ownership Types

Panel A: Bank-size Group	**ROE (%)**	**ROA (%)**	**Size (Log)**	**NPL (%)**	**DIV (%)**
Small Banks (Small)	6.49	1.58	8.53	3.74	25.49
Medium-sized Banks (Medium)	15.18	1.18	12.19	1.56	17.99
Large Banks (Large)	17.15	1.1	14.17	1.13	15.06
Mean-comparison Tests					
Small vs. Medium	8.69***	-0.39***	3.65***	-2.18***	-7.51***
	[9.68]	[-3.33]	[35.25]	[-3.07]	[-4.73]
Small vs. Large	10.7***	-0.47***	5.63***	-2.62***	-10.4***
	[13.54]	[-3.24]	[46.49]	[-3.11]	[-5.13]
Large vs. Medium	-1.97**	0.08	-1.98***	0.44	2.93***
	[-2.37]	[1.07]	[-25.55]	[1.11]	[3.43]
Panel B: Ownership Type	**ROE (%)**	**ROA (%)**	**Size (Log)**	**NPL (%)**	**DIV (%)**
Public banks (S)	18.32	0.99	13.56	1.66	13.53
Private domestic banks (P)	12.89	1.01	11.73	1.57	15.1
Private foreign banks (F)	8.71	1.79	9.82	2.78	29.09
Total (All Banks)	13.5	1.26	11.77	2	19.13
Mean-comparison Tests					
S vs. P	-5.42***	-0.02	-1.83***	-0.09	1.57***
	[-6.32]	[-0.33]	[-15.12]	[-0.21]	[2.92]
S vs. F	-9.61***	0.80***	-3.74***	1.12	15.6***
	[-13.35]	[7.50]	[-22.37]	[1.56]	[10.78]
P vs. F	-4.18***	0.78***	-1.91***	1.21*	14.0***
	[-4.56]	[6.20]	[-9.45]	[1.78]	[8.68]

Note: t statistics in brackets. ***, ** and * indicate significant level of 1%, 5% and 10% respectively.

Table 2.4

Correlations between Independent Variables

	HHI	MS	SIZE	NPL	DIV	EQA	LTA	OPT	GTA	INF	INT	GDP
HHI	1.00											
MS	0.00	1.00										
Size	-0.14**	0.58***	1.00									
NPL	0.18***	-0.04	-0.19***	1.00								
DIV	0.08	-0.13**	-0.39***	0.03	1.00							
EQA	-0.04	-0.26***	-0.68***	0.09*	0.39***	1.00						
LTA	-0.20***	0.24***	0.62***	-0.23***	-0.37***	-0.53***	1.00					
OPT	0.05	-0.13**	-0.33***	0.08	0.63***	0.16***	-0.24***	1.00				
GTA	0.03	0.01	0.07	-0.07	0.03	-0.02	0.06	0.03	1.00			
INF	-0.54***	-0.01	0.15***	-0.20***	-0.06	0.03	0.18***	-0.09*	-0.06	1.00		
INT	0.53***	0.00	-0.10*	0.07	0.02	-0.04	-0.09*	0.07	0.06	-0.61***	1.00	
GDP	0.53***	-0.00	-0.05	0.05	0.01	0.01	-0.06	0.00	-0.04	0.00	0.00	1.00

Notes: HHI and MS are calculated based on total loans. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2.5

Market Structure and Determinants of Indian Banking Profitability

	1	2	3	4	5	6
	ROE	ROE	ROE	ROA	ROA	ROA
Concentration (HHI)	5.81**	29.3***	29.1***	0.023	1.42**	1.40**
	[2.55]	[4.55]	[4.51]	[0.34]	[0.55]	[0.55]
Market Share	-0.24	-0.17	-0.25	-0.019	-0.016	-0.011
	[0.20]	[0.21]	[0.19]	[0.017]	[0.018]	[0.019]
Bank size	0.022***	0.021***	0.014***	0.00075	0.00069	0.00065
	[0.0048]	[0.0044]	[0.0046]	[0.00046]	[0.00047]	[0.00057]
Credit Risk	-0.12**	-0.14*	-0.13*	-0.024**	-0.024**	-0.024**
	[0.059]	[0.071]	[0.066]	[0.010]	[0.011]	[0.011]
Diversification	0.22***	0.21***	0.22***	0.046***	0.046***	0.046***
	[0.052]	[0.052]	[0.054]	[0.0056]	[0.0060]	[0.0064]
Capitalisation	-0.083**	-0.079**	-0.068**	0.015**	0.015**	0.016**
	[0.042]	[0.039]	[0.031]	[0.0062]	[0.0063]	[0.0067]
Liquidity Risk	-0.022	-0.0072	-0.029	-0.005	-0.0047	-0.0055
	[0.035]	[0.034]	[0.032]	[0.0038]	[0.0037]	[0.0041]
Operating inefficiency	-1.19**	-1.07*	-0.98*	-0.13*	-0.13	-0.13
	[0.54]	[0.57]	[0.53]	[0.078]	[0.083]	[0.082]
Growth rate (Assets)	0.0035	0.0015	0.003	0.0004	0.00025	0.00035
	[0.0043]	[0.0043]	[0.0047]	[0.00033]	[0.00035]	[0.00033]
Time Trend	-0.0033	0.0052**	0.0067***	0.0003	0.00088**	0.00089**
	[0.0021]	[0.0026]	[0.0026]	[0.00024]	[0.00037]	[0.00039]
Inflation		-0.32*	-0.30*		-0.0048	-0.0041
		[0.18]	[0.18]		[0.027]	[0.027]
Interest Rate		-0.42***	-0.39***		0.012	0.013
		[0.14]	[0.14]		[0.014]	[0.013]
GDP		-1.23***	-1.24***		-0.086***	-0.086***
		[0.18]	[0.18]		[0.023]	[0.023]
Public Dummy			0.17***			0.0033
			[0.046]			[0.0034]
Foreign Dummy			-0.017			0.0011
			[0.019]			[0.0022]
% Govt.			-			-0.000073
			[0.00065]			[0.000049]
Old Bank			0.032			0.0034*
			[0.020]			[0.0018]
Constant	-0.44***	-1.69***	-1.62***	-0.0034	-0.079***	-0.080***
	[0.16]	[0.26]	[0.27]	[0.021]	[0.031]	[0.031]
Observations	568	568	568	568	568	568
No. of Banks	73	73	73	73	73	73
R^2	0.14	0.23	0.23	0.3	0.33	0.33
P[HT]	0.12	0.71	-	0.18	0.71	-
Decision	RE	RE	RE	RE	RE	RE
F/Wald Test	149.3***	231.4***	372.4***	116.6***	141.9***	175.3***

Note: (1) All estimations were carried out using Stata 11.1. (2) We estimate all regressions using bank fixed/random effects and clustering the errors at the bank level. (3) Heteroskedasticity and autocorrelation corrected robust standard errors are reported in bracket. (4)***, ** and * indicate significant level of 1%, 5% and 10% respectively. (5) P [HT] denotes the p-value of the Hausman test. (6) The F-test and Wald-test represent the fixed effects and random effects methods respectively.

Table 2.6a

The Influence of Bank Size in the Impact of Credit Risk and Diversification

	(1) ROE		(2) ROA	
Credit Risk	-0.19	(0.24)	-0.048	(0.034)
Bank Size	0.012	(0.017)	0.00058	(0.00064)
Credit Risk*Size	**0.0061**	**(0.029)**	**0.0025**	**(0.0035)**
Diversification	-0.42**	(0.17)	0.044**	(0.022)
Diversification*Size	**0.073*** **	**(0.019)**	**0.00018**	**(0.0021)**
Capitalisation	-0.026	(0.051)	0.015**	(0.0066)
Liquidity Risk	0.0046	(0.049)	-0.0046	(0.0039)
Op. Inefficiency	-1.23*	(0.71)	-0.12	(0.085)
Growth Rate (Assets)	0.00078	(0.0046)	0.00026	(0.00035)
Concentration (HHI)	27.7***	(4.40)	1.48***	(0.53)
Market Share	0.35	(0.75)	-0.015	(0.017)
Inflation	-0.37**	(0.18)	-0.0053	(0.027)
Real Interest Rate	-0.28**	(0.12)	0.012	(0.014)
GDP Growth Rate	-1.13***	(0.18)	-0.088***	(0.024)
Time Trend	0.0072*	(0.0041)	0.00092**	(0.00038)
Constant	-1.56***	(0.30)	-0.081***	(0.031)
Observations	568		568	
No. of Banks	73		73	
R^2	0.27		0.33	
P[HT]	0.00		0.53	
Decision	FE		RE	
F/chi2	11.1***		161.1***	

See note of table 2.5. Robust standard error is in parenthesis.

Table 2.6b

Marginal effects of Credit Risk and Diversification on Profitability at different levels of Size Index

		Credit Risk (NPL) $\partial\Pi / \partial npl = \overline{\beta}_1 + \overline{\beta}_3 * Size$		Diversification (DIV) $\partial\Pi / \partial div = \overline{\beta}_4 + \overline{\beta}_5 * Size$	
		Evaluated at various values of Size			
Values of Size Index	Percentile of Size	ROE	ROA	ROE	ROA
8.423	10th	**-0.143*** ** **(0.055)**	**-0.026*** ** **(0.009)**	**0.200*** ** **(0.037)**	**0.045*** ** **(0.006)**
10.455	25th	-0.130 (0.087)	**-0.021** ** **(0.010)**	0.349*** (0.049)	**0.046*** ** **(0.005)**
12.381	50th	-0.118 (0.135)	-0.017 (0.014)	0.491*** (0.078)	0.046*** (0.007)
13.437	75th	-0.112 (0.164)	-0.014 (0.017)	0.568*** (0.096)	0.047*** (0.009)
14.165	90th	-0.107 (0.183)	-0.012 (0.019)	0.621*** (0.109)	0.047*** (0.010)
14.634	95th	-0.104 (0.196)	-0.011 (0.021)	0.656*** (0.117)	0.047*** (0.011)
11.769	Mean	-0.122 (0.119)	-0.018 (0.013)	0.446*** (0.068)	**0.046*** ** **(0.006)**

Note: Π denotes the measures of profitability (i.e., return on equity and return on assets).

Table 2.7

The Influence of Ownership on the Impact of Credit Risk and Diversification

	(1) ROE		(2) ROA	
Public Bank (Dummy)	0.019	(0.037)	-0.0022	(0.0022)
Foreign Bank (Dummy)	0.014	(0.033)	-0.0028	(0.0030)
Public*Credit Risk	**-0.058**	**(0.12)**	**-0.0012**	**(0.0053)**
Private*Credit Risk	**-0.84**	**(0.51)**	**-0.035**	**(0.054)**
Foreign*Credit Risk	**-0.14*****	**(0.052)**	**-0.034*****	**(0.010)**
Public*Diversification	**0.56*****	**(0.16)**	**0.036*****	**(0.011)**
Private*Diversification	**0.50****	**(0.20)**	**0.029*****	**(0.011)**
Foreign*Diversification	**0.18*****	**(0.052)**	**0.047*****	**(0.0071)**
Bank Size	0.012**	(0.0049)	0.00072	(0.00056)
Capitalisation	-0.085**	(0.034)	0.015**	(0.0063)
Liquidity Risk	-0.0013	(0.031)	-0.0048	(0.0039)
Operational Inefficiency	-1.13**	(0.56)	-0.14	(0.083)
Growth Rate (Assets)	-0.00045	(0.0046)	0.00033	(0.00033)
Concentration (HHI)	28.3***	(4.64)	1.71***	(0.52)
Market Share	-0.32*	(0.17)	-0.012	(0.017)
Inflation	-0.34*	(0.18)	-0.0067	(0.027)
Real Interest Rate	-0.29**	(0.14)	0.0015	(0.014)
GDP Growth Rate	-1.15***	(0.18)	-0.097***	(0.024)
Time Trend	0.0089***	(0.0025)	0.00084**	(0.00038)
Constant	-1.59***	(0.27)	-0.092***	(0.029)
Observations	568		568	
No. of Banks	73		73	
R^2	0.26		0.34	
Wald Test	387.4***		204.0***	

See note of table 2.5. Robust standard error is in parenthesis.

Table 2.8

Robustness: Market Structure and Determinants of Indian Banking Profitability

	Attrition Effect				**10% Outlier Correction**			
	1		2		3		4	
	ROE		**ROA**		**ROE**		**ROA**	
Concentration ratio (CR5)	1.57**	[0.61]	0.16**	[0.071]	2.24***	[0.64]	0.20***	[0.072]
Market Share	0.21	[0.71]	-0.018	[0.018]	-0.033	[1.58]	0.016	[0.056]
Bank Size	0.028**	[0.013]	0.00072	[0.00046]	0.041**	[0.018]	0.00066	[0.00066]
Credit Risk	-0.12*	[0.067]	-0.023**	[0.011]	-0.17	[0.19]	-0.021	[0.016]
Diversification	0.24***	[0.062]	0.048***	[0.0059]	0.40***	[0.075]	0.050***	[0.0069]
Capitalisation	-0.018	[0.045]	0.014**	[0.0063]	-0.043	[0.067]	0.013*	[0.0078]
Liquidity Risk	-0.067	[0.050]	-0.0054	[0.0037]	-0.065	[0.064]	-0.006	[0.0049]
Operating inefficiency	-1.04	[0.68]	-0.14	[0.084]	-1.55	[1.02]	-0.22**	[0.096]
Growth rate (Assets)	0.0045	[0.0050]	0.00037	[0.00032]	0.0028	[0.0056]	0.00028	[0.00036]
Inflation	0.21	[0.18]	0.012	[0.027]	0.11	[0.24]	0.021	[0.027]
Interest Rate	-0.44***	[0.13]	-0.006	[0.015]	-0.43***	[0.14]	0.0019	[0.016]
GDP	-0.61***	[0.13]	-0.057***	[0.020]	-0.66***	[0.15]	-0.053***	[0.019]
Time Trend	-0.0035	[0.0039]	0.00093**	[0.00046]	0.000039	[0.0051]	0.0012***	[0.00038]
Constant	-0.76**	[0.29]	-0.067**	[0.030]	-1.20***	[0.31]	-0.083**	[0.033]
Observations	549		549		456		456	
No. of Banks	70		70		66		66	
R2	0.18		0.34		0.25		0.33	
P[HT]	0.05		0.62		0.03		0.39	
Decision	FE		RE		FE		RE	
F/Wald test	8.45***		129.1***		14.1***		154.2***	

See note of table 2.5. Robust standard error is in parentheses

Chapter III

Corporate Debt Restructuring, Bank Competition and Stability: Evidence from India

Abstract

This paper estimates the causal effect of a unique programme of corporate debt restructuring (CDR) on the stability of Indian banks for the period 1992-2012. The banks who participated in the programme were extended regulatory forbearance on asset classification and provisioning on the restructured corporate loans. We find that the banking stability of the participated banks increases substantially after the implementation of the programme. Following the recent development in measuring market power, we estimate efficiency-adjusted Lerner indices along with conventional ones using stochastic frontier analysis approach, and check for the interactive effect of CDR on bank stability. The result shows that the positive effect of CDR on stability declines at the higher degree of market power of the participated banks. To provide unbiased treatment effects of CDR eliminating any sample selection problem, we confirm our result using a number of alternative matching estimators including recently developed bias-corrected covariate matching estimator. Investigating the ambiguous trade-off between market power and stability, we find that greater pricing power reduces the risk-taking behaviour of banks. It also reveals that although the second phase of deregulation improved overall banking stability significantly, there is a threshold level of market power below which banks experience a higher risk of fragility. Our results remain insensitive to an array of robustness tests.

3.1 Introduction

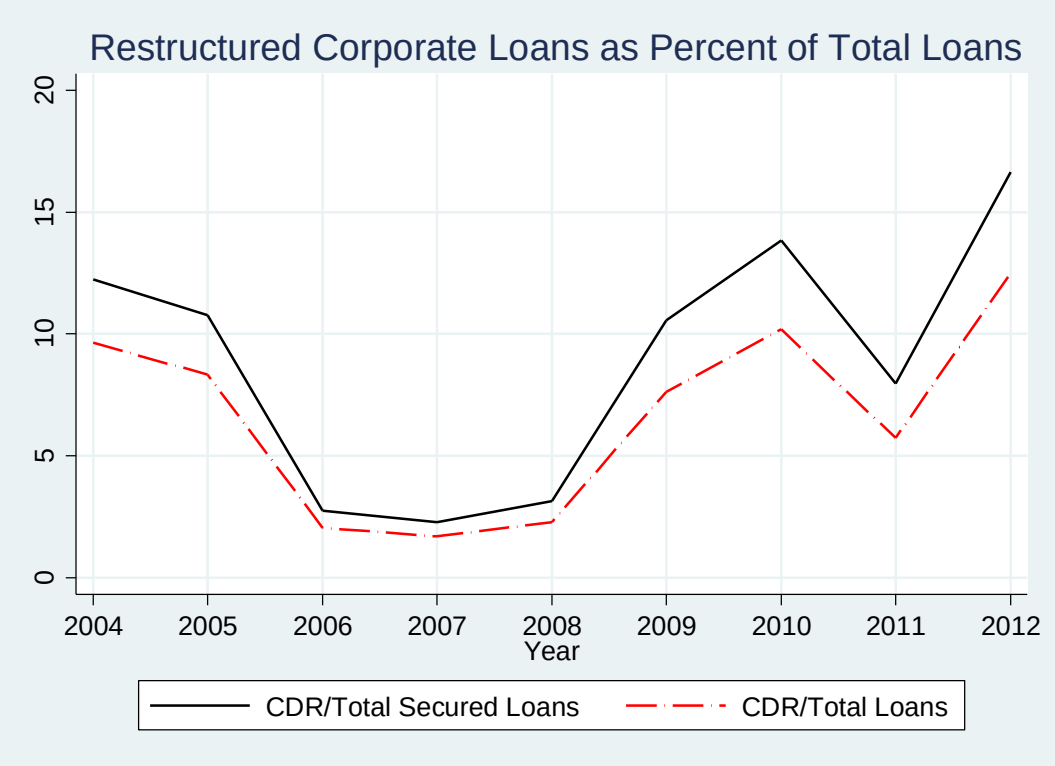
Maintaining a reasonable level of banking competition and stability is the ultimate objective of regulators in the world, including central banks such as the Reserve Bank of India (henceforth RBI). RBI initiated two phases of banking reforms in the 1990s to reduce the market power and risk-taking attitudes of banks. However, in the beginning of the 2000s, Indian corporates faced increasing challenges in meeting their debt servicing obligations to the banks/financial institutions. Since high corporate debt overhang[27] poses a risk to banks' balance sheets and financial stability due to increasing nonperforming loans (NPLs) and corporate bankruptcies (Goretti and Souto, 2013), RBI introduced an out-of-court restructuring programme in the form of 'Corporate Debt Restructuring' (henceforth CDR; see sub-section 3.2.2). The intention was to provide a speedy, cost effective, and market friendly alternative to in-court restructuring procedures (Claessens, 2005; Liu and Rosenberg, 2013) in order to bring the credit market out of a downward spiral and to assist in reviving viable corporates.

The net effect of CDR emanated in two ways: on the one hand, corporates were able to maintain their investments and value and forestall bankruptcy and on the other hand, the bank who participated in the restructuring of corporate debts (henceforth member banks) under CDR were able to minimise their exposures to those sick corporates and maintain banking stability through various channels. In this paper, we therefore are interested in the latter aspect of CDR and investigate empirically whether member banks have benefited from restructuring corporate debts and enhanced their stability by using the largest panel data taken from the RBI for the period 1992-2012.

[27] Myers (1977) demonstrated that 'debt overhang' is a state when corporates are discouraged from extending investments on new productive projects fearing of defaulting on existing outstanding risky debts, and thus impair economic growth.

Figure 3.1

Restructured corporate loans as percentage of total loans after the genesis of CDR.



As per CDR norms, member banks could retain the asset classification of restructured loans, and even could upgrade nonperforming restructured assets to a standard (performing) category after a specified period and charge less to their net income for loan loss provisions (Working-Group, 2012 henceforth WG). This special regulatory forbearance on asset classification and provisioning gave more opportunities to member banks to understate nonperforming loans and overstate net income. Banks benefited more after the global financial crisis as they restructured more loans during the post crisis period. Figure 3.1 shows that the total restructured corporate loans as a percentage of total loans have reached to 12.5% from just 2% in 2006. It is documented both theoretically and empirically that by using *ex-ante* loan loss provisions, banks can reduce the volatility of

their current profitability i.e., smoothing income (e.g., Fudenberg and Tirole, 1995; Lobo and Yang, 2001; Goel and Thakor, 2003; Shrieves and Dahl, 2003). Through income smoothing banks can also reduce the possibility of depleting their capital (Laeven and Majnoni, 2003). Therefore, we expect a positive correlation between member banks and their stability.

We contribute to the existing literature in several ways. First, we attempt to add to the literature on corporate debt restructuring from the creditors' perspective by investigating the impact of the unique institutional mechanism of India on the bank stability of the treatment group while using a 'natural experiment' type difference-in-differences (DID) approach (see Bertrand and Mullainathan, 2003) and nonparametric matching estimators (see Abadie and Imbens, 2006; Imbens and Wooldridge, 2009). This modeling strategy is appropriate to establish causal claims and to investigate the effects of a programme implementation among treated and control groups. This approach allows us to capture the mean difference in the outcome variable between treated and control groups after implementation of the programme removing biases due to economic trends of the two groups. In our case, it captures the mean difference of bank-level stability between member banks and non-member banks after the genesis of the CDR programme in India. Comparing the performance of the treated group allows us to capture the effect of the programme removing any bias due to other omitted time invariant factors (Imbens and Wooldridge, 2009; Fang, Hasan and Marton, 2014). As a robustness test, to eliminate any sample selection bias, we also employ alternative estimators including the bias-corrected covariate matching methods recently developed by Abadie and Imbens (2006). Since the matching methods are nonparametric in nature, they can alleviate sample selection bias by formally controlling for the non-random selection problem and avoid the specification of the functional form (Imbens and Wooldridge, 2009). Second, from the economic policy standpoint, it is important to investigate the impact of the regulatory forbearance under the

guise of the CDR system on the member banks' stability so that appropriate action can be taken to reduce excessive risk-taking not only by the Indian policymakers but also in other emerging market economies in case of such widespread corporate sickness.

In the last two decades, the Indian banking sector has undergone numerous structural changes. However, studies on the impact of such changes on bank risk-taking attitude is limited given that India is one of the fastest growing emerging market economies in the world.[28] Therefore, we complement the existing literature on *market power-stability nexus* by drawing evidence from India. The existing literature is divided and yet to reach a consensus on the question of whether greater market power is good or bad for banking stability. This question has been at the epicenter for the last two decades and recently, after the global financial crisis in 2008, it has attracted renewed attention from the academics and regulators (Keeley, 1990; Allen and Gale, 2004; Schaeck, Cihak and Wolfe, 2009; Martinez-Miera and Repullo, 2010; Beck, De Jonghe and Schepens, 2013; Anginer, Demirgüç-Kunt and Zhu, 2014). Furthermore, the findings of the existing studies are partially contradictory because of cross country variation and the methodology adopted in measuring market power.[29] Therefore, considering the recent development in measuring bank competition, we estimate two variant measures of market power proxied by conventional Lerner indices (Berger, Klapper and Turk-Ariss, 2009) and efficiency-adjusted Lerner indices from a stochastic frontier analysis approach (Koetter, Kolari and Spierdijk, 2012). In addition, to eradicate any endogeneity problems between market power and bank stability, we also employ an instrumental variable technique with a Generalised Method of Moments (GMM) estimator using the kernel-based heteroskedasticity and autocorrelation consistent (HAC) variance estimation of Newey and West (1987). All these approaches will allow us to dispel any concern about the incorrect

[28] See for example Tzeremes (2015).
[29] See for example Beck, De Jonghe and Schepens (2013) and Anginer, Demirgüç-Kunt and Zhu (2014).

measures of market power/endogeneity problem, and thus provide robust analysis aiming at facilitating reliable policy decision making.

The rest of the paper is organised as follows. Section 3.2 provides a brief overview of the regulatory framework and CDR mechanism in India. In section 3.3, we develop theoretical hypotheses. Section 3.4 outlines the empirical models and Section 3.5 describes the data and descriptive statistics. Section 3.6 explains the estimation results, discussing the effects of competition on the stability of banks, and presents the results of the causal effect of CDR on stability with all sensitivity analyses. The concluding remarks are provided in Section 3.7.

3.2 Deregulation and corporate debt restructuring in India

3.2.1 Deregulation

The Indian banking sector comprises public sector banks, private sector banks and foreign banks. In the 1950s, the limited regulatory control over interest rates and trivial pre-emption of funds in the financial system resulted in inequitable distribution and misallocation of credit (Das and Kumbhakar, 2012). To ensure proper allocation of credit in the priority sectors, the Indian government tightened its control over credit allocation and introduced administered interest rates both on deposits and loans, high reserve requirements and rigorous statutory liquidity restrictions, which culminated with the nationalisation of 20 major commercial banks between 1969 and 1980 (Das, Nag and Ray, 2005; Bhattacharyya and Pal, 2013). The net effect of this overregulation resulted in an inefficient allocation of resources, high operating costs, declining profitability and deteriorated asset quality.

In 1992, the RBI started the liberalisation process stressing deregulation and opening up of the banking sector to market forces aimed at providing operational flexibility and functional autonomy. Since then it has been consistently working to establish a sound

regulatory framework in order to facilitate effective supervision and institutional infrastructure. The diversification of ownership through considerable dilution of capital by the government reduced overpowering of state-owned banks, and yielded a level-playing field for all. This first phase of reforms improved the competitiveness and efficiency in the resource allocation process of the banking sector and strengthened the transmission mechanism of monetary policy including reduction in statutory liquidity ratio (SLR), cash reserve ratio (CRR), permission for de novo entry of banks in the private sector, and deregulation of interest rates.

The second phase of reform started in 1998 with the aim of enhancing banking stability through improved banking regulation, increasing competitiveness, adoption of capital adequacy norms, prudential norms for asset classification and provisions for delinquent loans in line with global practices. To adhere to the stipulated capital adequacy norms, a substantial amount of capital was injected by the government of India to the public sector banks. To this end, there has been a wave of mergers and acquisitions conducted both according to the market principles and with the assistance of government (Fujii, Managi and Matousek, 2014). In the recent past, the strengthening of Debt Recovery Tribunals (DRTs), the inauguration and successful implementation of new institutional mechanisms *viz.* SARFAESI (Securitisation and Reconstruction of Financial Assets and Enforcement of Securities Interest) Act 2002 and CDR system facilitated the expedition of recovery of loan arrears. In the case of the DRT Act, special tribunals were set up by the government of India to facilitate the speedy recovery of defaulted loans without needing Civil Procedure Code. In the case of the SARFAESI Act, the rights of the secured creditors were strengthened and thereby banks were allowed to seize and liquidate the assets of the defaulted firm without much delay. Visaria (2009) and Vig (2013) provide detailed discussion on DRT and SARFAESI Acts, respectively. In the following sub-section we discuss the CDR in detail.

3.2.2 Corporate debt restructuring

In the late 1990s, Indian corporates faced unprecedented financial distress to be able to meet the repayment obligations. To reduce the 'debt overhang' problem of corporates as well as bring the credit market out of the downward spiral, RBI sponsored a restructuring mechanism in the form of CDR in 2002. However, prior to CDR, in case of in-court restructuring of corporate debts, the Board for Industrial and Financial Reconstruction (BIFR), an agency of the government of India, similar to the US Chapter 11 Bankruptcy Code, was set up under the Sick Industrial Companies Act 1985 to determine the sickness of industrial companies and to help in reviving the viable economically efficient entity and shutting down the economically inefficient ones. In recent years, the misuse and the Indian law's indefinite nature of respite made it a haven for promoters of sick companies.

CDR is an efficient out-of-court institutional mechanism for banks/financial institutions to restructure corporate debts (e.g., secured by tangible assets). To participate in the restructuring, a bank needs to be a member of the system and sign the debtor-creditor agreement (DCA) and inter-creditor agreement (ICA), which extend legal support for the CDR.[30] The CDR aims at speedy restructuring of the dues of banks/financial institutions in a transparent manner to minimise their losses where they have an exposure of Rs. 100 million and above in the multiple banking/syndicates/consortium accounts.[31] It is a three-tiered mechanism with a standing forum, empowered group and the CDR cell. While the standing forum sets comprehensive policies and guidelines, the CDR cell in conjunction with the lenders does the preliminary analysis of proposals and provides a detailed restructuring plan, and finally, the empowered group deliberates and approves the

[30] In the former case, both debtor and creditor(s) agree to stay away from recourse to any legal action during restructuring period of 90/180 days, and in the latter case, all member banks/institutions of the CDR system sign an agreement whereby they are legally binding with necessary enforcement and penal clauses.
[31] For more information about corporate debt restructuring please see various circulars of RBI compiled at: http://www.cdrindia.org/rbi.htm

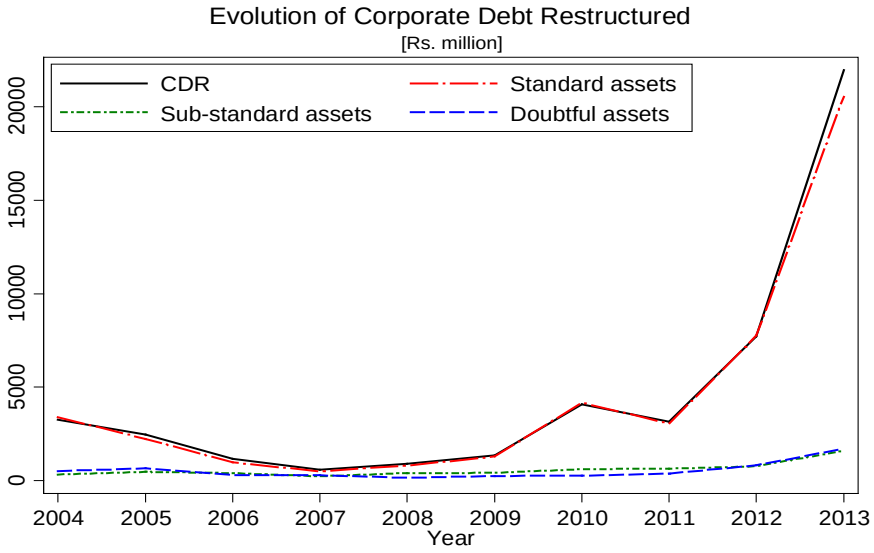
restructuring proposals. Corporate loans will go ahead for restructuring if they have the support of 75% of the creditors by value, and 60% by number (RBI, 2005b). In 2003, in order to make the CDR mechanism more efficient and barring the willful defaulters, the CDR scope was extended to include 'standard' loan assets, 'doubtful' loan assets and the cases of BIFR of just 'sub-standard' loan assets previously.[32]

Special regulatory forbearance on asset classification and provisioning was extended to the restructured assets. Any standard assets can retain assets classification upon restructuring without slipping into the lower asset categories as per the CDR scheme. Banks were also allowed to make concessional provisions of 2% on any restructured standard assets.[33] In addition, if any restructured account had nonperforming assets (i.e., sub-standard and doubtful), it can be upgraded into the standard (performing) assets category after a specified period (i.e., one year), if it can be shown that the obligations are met by the borrowers as per the CDR norm.[34] According to the guidelines of RBI, if restructured nonperforming assets remain in the same category, provisioning has to be made and income can be recognised only on a cash basis (realisation) (Vaidyanathan, 2013). However, a recent report by Working Group reveals that according to the global practice any assets restructured should fall in the lower asset category and loan loss provisions should be made accordingly (WG, 2012).

[32] Based on assets classification, accounts classified as 'standard' and 'sub-standard' were in the Category 1 CDR and accounts classified as 'doubtful' were in the Category 2 CDR.
[33] According to provisioning norms, in respect of sub-standard assets of secured category, banks are required to keep 10 per cent provision, and for the unsecured exposures, an additional 10 per cent, totaling 20 per cent (for details, Vaidyanathan, 2013).
[34] It is noted that specified period is defined as a period of one year from the date when the first payment of interest or instalment of principal falls due under the terms of the restructuring package (WG, 2012).

Figure 3.2

The evolution of CDR in India from 2004 to 2013



We can see from Figure 3.2 that after the global financial crisis in 2008 the corporate loan restructured increased by 744% from Rs. 913.4 million in 2008 to Rs. 7718.5 million at the end of 2012. Against this backdrop of substantial increase of restructured loans, on November 2012, RBI raised provision on restructured standard loans to 2.75% from just 2% previously. Provisioning on any new restructured standard loan is 5% from June 1, 2013. It has also decided to do away with the regulatory forbearance on asset classification and provisioning from April 1, 2015 (RBI, 2013).

A plethora of anecdotal evidence suggests that the CDR system has a significant effect on the bottom lines of the member banks. A report of Standard Chartered Securities published in many local newspapers stated that the increased provisioning requirement is likely to erode 18% of profitability from the public sector banks.[35] Many critics expressed concerns that the CDR system is a conduit for bankers to hide NPLs and hike income, which will have a deleterious effect on the impairment of assets in the future. It was also

[35] http://articles.economictimes.indiatimes.com/2012-07-24/news/32828003_1_state-run-banks-cent-private-sector-banks

echoed by the deputy governor of RBI, K.C. Chakrabarty that “If the reason for the recent increase in restructured accounts is indeed the economic downturn, it should have been reflected across all bank groups and not just public sector banks." It was reported that there was forced debt restructuring of loss making public sector entities while retaining those potential NPLs as standard restructured assets.

3.3 Review of Related Literature

The main research questions in this article are whether market power influences the risk of banks and whether CDR reduces risk of member banks under the CDR mechanism. We develop hypotheses based on the literature regarding market power-stability nexus and *ex-post* credit risk and CDR.

3.3.1 Market power-stability nexus

From a theoretical and empirical point of view, there is an ambiguous relationship between the market power and stability of a bank. The stability in the banking sector heavily relies on the degree of competition that the banking sector possesses. The first theoretical model in Marcus (1984) shows that if there is competition in the deposit market, banks undertake risk taking strategies because of the contraction in the banks’ franchise value, which is well-known as the ‘franchise value’ hypothesis in banking. The first empirical study of Keeley (1990) on the U.S. banking industry in the aftermath of financial deregulation shows that greater competition reduces the franchise value of banks and then increases the banks’ incentive to take excessive risk. The advocates of ‘market power-stability’ view argue that more concentrated and less competitive banking systems are more stable because the excessive profit they make provides a “buffer” against fragility and provides incentives against excessive risk taking (Beck, 2008).

However, the relationship between market power and stability can also be negative. Boyd and De Nicolo (2005) introduce the ‘competition-stability hypothesis’ and

argue that greater competition contributes to sustaining stability in the banking market. The basis of their arguments expounds moral hazard and adverse selection problems of customers in the deposit market. They argue that higher market power of banks increases the borrowing cost for entrepreneurs which induces borrowers to opt for risky projects to mitigate the extra repayment they incur from the loans which in turn increases entrepreneurial default risk. In other words, this harder repayment strategy exacerbates moral hazard incentives of borrowers and banks end up with a riskier set of clients due to adverse selection considerations (Berger, Klapper and Turk-Ariss, 2009; Turk Ariss, 2010). More recently, using cross-country data, Beck, De Jonghe and Schepens (2013) find a negative relationship between bank competition and stability while the finding of Anginer, Demirgüç-Kunt and Zhu (2014) is completely opposite. Therefore, the findings based on cross-country analysis or from developed market economies would be hard to generalise in the case of emerging market economies, especially for India, which has undergone substantial regulatory changes in the recent past.

Hypothesis 1: Market power effect can be positively associated with bank stability.

3.3.2 Debt restructuring and banking stability

In this section, we argue for a positive relationship between banking stability and member banks of CDR who relished substantial regulatory forbearance on asset classification, provisioning and capital adequacy. We measure bank stability with bank-specific Z-scores, which are calculated as the sum of the return-on-assets (ROA) and capital ratios, scaled by standard deviation of the ROA (for details see section 3.5).

Since member banks of the CDR system were extended regulatory forbearance on asset classification and provisioning, we assume that they reduce risk through changes in profitability, capital adequacy, or a combination of both. Unlike the literature on performance evaluation of corporates after restructuring debts, no general model exists

from the creditors' perspective (Kang and Shivdasani, 1997). However, existing literature implicitly indicates how member banks could affect profitability and capital adequacy via loan loss provisioning, and thereby their stability.

Regarding the profitability channel, member banks may have increased profitability and thus stability because they had more opportunities to understate nonperforming loans and overstate net income through exploitation of the CDR system. As per CDR norms, member banks could retain the asset classification of restructured loans and charge less to their net income for loan loss provisions (WG, 2012) which should have been higher if they did not have regulatory forbearance on asset classification and provisioning, and thus would have lower net income. Previous literature on income smoothing argues that banks can use loan loss provisions to increase current profitability (e.g., Fudenberg and Tirole, 1995; Lobo and Yang, 2001; Shrieves and Dahl, 2003).[36] According to Fudenberg and Tirole (1995), bank managers during lean (fat) years charge less (more) loan loss provisions to the net income by shifting future (current) earnings to the current (future) period in order to increase (decrease) profitability. Ghosh and Nachane (2003) find evidence of income smoothing in India for a sample of state-owned banks for the period 1997-2002.

By smoothing income, banks not only can reduce volatility of their revenue but also reduce the possibility that it may have to eat into their capital (Laeven and Majnoni, 2003). According to the new Basel capital adequacy framework, general provisions are included in the calculation of Tier-2 capital not exceeding 1.25 per cent of risk-weighted assets. Therefore, if member banks are not capital-constrained they will have less incentive to charge higher loan loss provisions to manage regulatory capital. On this issue Bikker and Metzemakers (2005) and Bushman and Williams (2012) find a negative relationship

[36] Income smoothing refers to the practice of minimising variations in earnings over time through a deliberate damping of fluctuations.

between loan loss provisions and capital ratios.

In the context of multiple/consortium/syndicate accounts, creditors coordinate and cooperate regularly and intensively in the restructuring of distressed borrowers (e.g., Franks and Sussman, 2005; Brunner and Krahnen, 2008). Vig (2013) did not find any evidence of creditor run or coordination problems among Indian banks in the case of multiple banking accounts for a sample of banks during 1997-2004. Rajan (1992) shows that banks realise more benefits through multiple banking than single banking account financing. It is noted that in the CDR mechanism creditors are the close monitors of the restructured corporate loans. By using out-of-court restructuring of corporate loans, member banks not only get respite from expensive and unending legal proceedings but also they can free up additional resources to invest in more productive intermediation activities, and thus earn more profits. They can turn potential nonperforming assets (i.e., non-income yielding assets) into performing assets (income yielding assets), and by so doing, member banks can increase profitability and simultaneously reduce stress on provisioning, capital adequacy, liquidity and net interest margin, and thereby increase competitiveness with reduced operating costs.[37]

Summing up, the increasing profitability because of favorable regulatory forbearance on asset classification and provisioning as well as costs savings in managing nonperforming loans enable member banks of the CDR system to enhance their stability. However, the alluded concessional loan loss provisions on restructured corporate loans have direct implications on the mark-up of the banks and their market power. Due to increasing market power, member banks may have shown delinquency in determining the riskiness of their portfolios. Besides, since the aim of the financial reforms was to enhance market mechanism, transparency and banking competition, we may expect individual

[37] See Jensen and Meckling (1979) for details on direct and in-direct costs related to bankruptcy by firms.

banks' pricing power can channel through CDR and induce excessive risk-taking, which is an empirical issue.

Hypothesis 2a: CDR can have a positive effect on stability of member banks.

Hypothesis 2b: The positive effect of CDR on stability reduces at a higher degree of market power.

3.4 Methodology

3.4.1 The impact of competition on bank risk-taking

We test whether bank competition impacts the stability of Indian banks using bank-level data. To circumvent the potential endogeneity issue with the measure of market power we follow recent empirical studies (e.g., Berger, Klapper and Turk-Ariss, 2009; Tabak, Fazio and Cajueiro, 2012; Fu, Lin and Molyneux, 2014) and employ an instrumental variable technique with a GMM estimator using the kernel-based heteroskedasticity and autocorrelation consistent (HAC) variance estimation of Newey and West (1987). The advantage of using this method is twofold. First, it is robust to the presence of some unobserved characteristics, influencing both market power and stability, or by reverse causality; and second, it does not require any assumptions about error distributions and, therefore, it is robust to the arbitrary heteroskedasticity and autocorrelation of disturbance terms (Hansen, 1982). The regression model is as follows:

$$Bank\ risk_{it} = \alpha_i + \alpha_t + \beta_1 Lerner_{it} + \beta_2 dreg_t + \sum \gamma \cdot (Bank\ Controls)_{it} + \sum \delta \cdot (Macro)_{it} + \varepsilon_{it} \quad (2.4)$$

where i denotes individual banks and t indexes years. The dependent variable is the individual bank risk at time $_t$. The main independent variable of interest is the Lerner index, a proxy for individual bank market power at time $_t$. We use either conventional

Lerner index i.e., C-Lerner or efficiency-adjusted Lerner index i.e., E-Lerner. The second variable of interest is the deregulation dummy (i.e., dreg) that takes a value equal to one for the year 1998 and thereafter, or else zero. We control for various bank-specific characteristics as well as macroeconomic variables. The detailed definition of these variables can be found in Table 3.1.

3.4.2 The impact of corporate debt restructuring (CDR) on bank stability

We examine the effect of CDR on bank stability by using a difference-in-differences (DID) approach following Bertrand and Mullainathan (2003) and Koetter, Kolari and Spierdijk (2012).[38] This methodology is simple yet powerful enough to identify the effect of an event (in our case, it is the emergence of the CDR mechanism) on groups who are affected by the institutional mechanism (henceforth treated) with those that are unaffected (henceforth control). For our case, the variable of interest is the stability of banks. To understand the effect of CDR on stability, we could simply get the difference between the stability (i.e., Z-Score) of treated banks before and after the CDR mechanism. The difference would suggest the effect of the CDR mechanism increasing/decreasing banking stability. However, the factors other than CDR, both observable and non-observable, potentially impacting banking stability may have changed as well. Therefore, the common economic shock warrants having a control group, which is likely to eliminate the bias that emanates from changes other than the CDR mechanism that could have affected the treated group (Imbens and Wooldridge, 2009; Vig, 2013; Fang, Hasan and Marton, 2014). The bank-level estimation of this approach is as follows:

[38] The key assumption "parallel trends" requires that the average changes of the outcome variable between the controls and treated are symmetrical in the absence of treatment. Therefore, following Lemmon and Roberts (2010) we run the two-sample Wilcoxon test to check for the parallel trends in the pre-implementation period of CDR. We cannot reject the null hypothesis at the 5% level that the two samples are taken from populations with the same median.

$$Bank\ risk_{it} = \alpha_0 + \alpha_i + \alpha_t + \beta_1 \cdot CDR_{it} + \beta_2 Lerner_{it} + \sum \gamma \cdot (Bank\ Controls)_{it} + \sum \delta \cdot (Macro)_{it} + \varepsilon_{it} \quad (2.5)$$

The dependent variable is individual banks risk at time t . The CDR is an indicator variable that takes a value equal to one if a bank signs an inter-creditor agreement (ICA) and becomes a member of the CDR program in 2003 and thereafter or else zero.[39] Since there is a time lag reaping the benefit of restructured loans we use a lag of one period of CDR (see Gertler, Martinez, Premand, Rawlings and Vermeersch, 2011; Fang, Hasan and Marton, 2014). We are interested in estimating β_1, which captures the treatment effects of CDR on banking stability.[40] In other words, it captures the mean difference in the stability between member banks and non-member banks after the genesis of the CDR system. Lerner is either C-Lerner or E-Lerner for bank i at time $t-1$ to account for any endogeneity issue. We specify the analogous bank-specific and macroeconomic control variables as in equation (3.1).

While CDR has direct impacts on bank stability, all things being equal, it may also have contingent effects with bank competition. To examine whether Lerner indices interact with CDR as a mechanism to induce excessive risk-taking, we use a difference-in-difference-in-differences (DDD) approach.[41] This approach allows us to investigate the cross-sectional heterogeneity in the competition of treated and control groups and

[39] 47 institutions/banks signed ICA in February 2002, and CDR became operational in March 2002. In February 2003, CDR's scope was widened to include doubtful and BIFR cases and even standard loan assets. Therefore, we have constructed the CDR indicator variable based on financial year 2002-2003.

[40] It is important to note that the CDR mechanism only applies to the banks that are signatories of inter-creditor agreement (ICA). However, there are a small number of banks who adopted a transaction-based membership and signed ICA for a single transaction of restructuring of corporate debts at different points in time after the genesis of CDR. Since most of the restructuring of corporate debts is undertaken by the ICA members (almost 98.3%), in reality, this distinction is trivial. However, we constructed another CDR indicator where transaction-based members were also taken into consideration by taking a value equal to one for that particular bank for that particular year, and the overall results remain unchanged and are available from the authors upon request.

[41] See for example Long, Yemane and Stockley (2010) and Vig (2013).

examines the magnitude of the effect of individual bank's competition on stability since the genesis of the CDR mechanism.

$$Bank\ risk_{it} = \alpha_0 + \alpha_t + \beta_1 \cdot (CDR)_{it} + \beta_2 Lerner_{it} + \beta_3 \cdot CDR_{it} \times Lerner_{it} + \sum \gamma \cdot (Bank\ Controls)_{it} + \sum \delta \cdot (Macro)_{it} + \varepsilon_{it} \quad (2.6)$$

where the coefficient β_3 captures the DDD effect and represents the difference in the effect of an individual bank's competition on stability between before and after the CDR mechanism and between member and non-member banks.[42] This approach captures the time change to the average impact of an individual bank's competition for member banks by netting out the change in the average effect for non-member banks.

3.5 Data and descriptive statistics

To investigate the relationship between CDR, market power, and risk, we draw data from a number of sources: (1) the bank level dataset compiled from the RBI, from the Reports on trend and Progress of Banking in India for various years, (2) the macro data compiled from the World Bank World Development Indicators (WDI), and (3) IV instrument, the Business Freedom from the Heritage Foundation. Our dataset comprises of an unbalanced panel of up to 110 commercial banks from 1992-2012. We dropped banks that had information for fewer than three consecutive years, as the risk measures computed in this study were based on rolling windows over the past three years. We deflate all monetary values to 1994 (1993-94 = 100) prices using the wholesale price index (WPI) obtained from the Office of the Economic Advisor, Ministry of Commerce and Industry, Government of India, and the deflated series are reported in millions of Indian Rupees (INR).

[42] The advantage of using this approach is that it controls (nonparametrically) for any group-specific trends by adding interaction between group and year fixed effects (Vig, 2013).

3.5.1 Measuring bank risk

We follow Turk Ariss (2010) to measure $Z-score$ which is widely used in the literature and considered to be an unbiased and complete indicator of bank riskiness (see, for instance, Laeven and Levine, 2009; Fang, Hasan and Marton, 2014). Using assets returns, their volatility and leverage, we calculate $Z-score$ as follows:

$$Z-score_{it} = \frac{ROA_{it} + EQA_{it}}{\sigma_{it}^{ROA}} \tag{2.7}$$

where ROA and EQA are the average return-on-assets and the equity-to-assets ratio, respectively and σ^{ROA} is the standard deviation of return-on-assets. We can interpret this score as the number of standard deviations below the mean by which returns would have to drop before all equity in the bank gets depleted (Boyd and Runkle, 1993; Beck, De Jonghe and Schepens, 2013). If bank profitability is normally distributed, the inverse proxy of $Z-score$ can be considered as a bank's probability of default (Fu, Lin and Molyneux, 2014). In other words, higher returns and capitalisation would increase but volatile returns would decrease the stability of banks. It can also be measured by estimating the ratio of nonperforming loans and loan loss provision. However, these measures only reflect the credit risk of banks (Delis and Kouretas, 2011).

3.5.2 Measuring market power

We employ the Lerner index as a measure of market power of individual banks for the sample. The index is a more accurate measure of bank-specific market power than the so-called Panzar-Rosse H-statistics or the asset shares of the three largest banks (Brissimis, Delis and Papanikolaou, 2008). The essence of pricing power is reflected through the Lerner index because it measures the disparity between price and marginal cost expressed as a percentage of price. In other words, it captures the degree to which a bank can increase their marginal price beyond their marginal cost. According to Berger,

Klapper and Turk-Ariss (2009), the Lerner index is the only measure of market power calculated at the bank level as:

$$Lerner_{it} = \frac{P_{it} - MC_{it}}{P_{it}} \tag{2.8}$$

where P_{it} is the price of total assets proxied by the ratio of total revenue (interest and non-interest income) to total assets for bank i at time t. MC_{it} is the marginal cost of producing an additional unit of output. Following conventional bank efficiency studies, in this paper we use stochastic frontier analysis (SFA) to estimate marginal cost and hence the Lerner Index. The input and output choices are specified according to the intermediation approach of Sealey and Lindley (1977), where a bank uses labour and physical capital to accumulate deposits, and deposits are used to fund loans and other earning assets. Similar to Koetter, Kolari and Spierdijk (2012), a production technology is specified with three inputs (i.e. labour, capital and borrowed funds) and two outputs (i.e. loans and securities). Since equity can be used to fund loans it is commendable to include equity in the production function to account for various risk attitudes of banks. The assumption is that there is perfect competition in the factor markets and banks have no other choice but to accept the given factor prices in order to supply a certain number of outputs. The following translog total cost function is specified for bank $i = 1, ..., N$ at time $t = 1, ..., T$ as:

$$\begin{aligned}
\ln TOC_{it} &= \beta_0 + \sum_{j=1}^{3} \beta_j \ln \mathrm{W}_{j,it} + \sum_{p=1}^{2} \gamma_p \ln \mathrm{Y}_{p,it} + \delta \ln(\mathrm{Z}_{it}) + \sum_{j=1}^{3} (\frac{\varsigma_j}{2})(\ln W_{j,it})^2 \\
&+ \sum_{j}^{3} \sum_{k}^{3} \eta_{jk} \ln W_{j,it} \ln W_{k,it} + \sum_{p=1}^{2} (\frac{\theta_p}{2})(\ln \mathrm{Y}_{p,it})^2 + (\frac{\kappa_{12}}{2}) \ln Y_{1,it} \ln Y_{2,it} \\
&+ \sum_{j=1}^{3} \sum_{p=1}^{2} \lambda_{jp} \ln W_{j,it} \ln Y_{p,it} + \sum_{k=1}^{2} \rho_k trend^k + \sum_{j=1}^{3} \varepsilon_j \ln W_{j,it} trend + \sum_{p=1}^{2} \omega_p \ln \mathrm{Y}_{p,it} trend + \varepsilon_{it}
\end{aligned} \tag{2.9}$$

where TOC_{it} is the total costs including financial and operating cost; Y_{it} represents two outputs i.e., total loans $Y_{1,it}$ and total securities $Y_{2,it}$, and $W_{j,it}$ ($j = 1, 2, 3$) are

input prices where w_1 is the price of funds; w_2 is the price of labour; w_3 is the price of capital of bank i at time t ; z_{it} is total equity of bank i at time t ; and *trend* is the time trend to capture technical change. We impose homogeneity of degree one on input prices and divide all factor prices and TOC_{it} by w_3 . After estimating cost function, we take the first derivative with respect to outputs for each bank in the sample and estimate marginal cost as:

$$\begin{aligned} \mathrm{MC}_{it} = & \frac{TOC_{it}}{Y_{1,it}}\left[\gamma_1 + \theta_1 \ln \mathrm{Y}_{1,it} + (\frac{\kappa_{12}}{2}) \ln Y_{2,it} + \sum_{j=1}^{3} \lambda_{1j} \ln W_{j,it} + \omega_1 trend\right] \\ & + \frac{TOC_{it}}{Y_{2,it}}\left[\gamma_2 + \theta_2 \ln \mathrm{Y}_{2,it} + (\frac{\kappa_{12}}{2}) \ln Y_{1,it} + \sum_{j=1}^{3} \lambda_{2j} \ln W_{j,it} + \omega_2 trend\right] \end{aligned} \tag{2.10}$$

The Lerner index is interpreted as the inverse of competition; the higher the index the greater the pricing power, implying less competitive market conditions. The conventional Lerner index estimated above is measured assuming full bank efficiency and therefore does not account for the possibilities of bankers failing to exploit output pricing opportunities resulting from market power. Following Koetter, Kolari and Spierdijk (2012), we estimate efficiency-adjusted Lerner indices from a single structural model as:

$$(\widehat{AR_{it}} - MC_{it}) / \widehat{AR_{it}} \tag{2.11}$$

where $\widehat{AR_{it}}$ is the average revenue computed as $\widehat{TR} / TA$, where, $TR = \widehat{PBT} + \widehat{TOC}$. In order to obtain efficiency-adjusted Lerner indices we have to estimate expected profit $\widehat{PBT}$ from an alternative profit function[43] and expected total costs $\widehat{TOC}$ from equation (3.6). Dissimilar to conventional Lerner indices in equation (3.5), the estimation of efficiency-adjusted Lerner accounts for both bank efficiency and degree of market power simultaneously.

[43] To estimate expected profits ($\widehat{PBT}$) we use PBT (i.e. profit before tax) instead of TOC in equation (3.6) as the dependent variable. Following Bos and Koetter (2011), to account for individual bank losses, we use a negative profit indicator (NPI) in the profit function as many banks in our sample period incurred losses.

3.5.3 Bank-specific and macro control variables

Following recent banking studies, we also control for an array of bank-specific characteristics and macroeconomic variables. We control for bank size by using the logarithm of total assets to account for potential size effect on risk taking behaviour of individual banks. It is argued in the literature that the vanity of being too-big-to-fail can invigorate the risk taking attitude of large banks (Iannotta, Nocera and Sironi, 2007). However, it is also evident that large banks can exploit economies of scale and enhance diversification opportunities, which in turn reduce the riskiness of their operations (Lepetit, Nys, Rous and Tarazi, 2008). Illiquid banks assume more risk as they are less aggressive towards profitability. To account for liquidity risk of individual banks, we use ratio of net loans over total assets (Fang, Hasan and Marton, 2014). To control for individual bank's loan portfolio risk we include the ratio of loan loss provision to total loans. Net interest margin is employed in the model to control for individual bank's lending attitude. The impact of income diversification on stability is ambiguous; therefore income diversification is used to capture the effect of off-balance sheet activities of banks. It is demonstrated in the literature that capital requirement and restrictions on interest rates and a bank's activities are likely to increase bank stability (Hellmann, Murdock and Stiglitz, 2000). In addition, a well-capitalised bank is assumed to take less risk; therefore we use equity ratio to control for capital risk.

The study also includes several macroeconomic variables to control for economic development and business cycle of the economy. We include GDP per capita to capture the level of economic development. Since, in the last two decades, the Indian economy has experienced substantial volatility, we use standard deviation of GDP (measured using 5-year rolling-window period) to control for volatility of economic growth. Lastly, since any major fluctuation in inflation can have serious implications towards banking profitability, and hence to the banking stability (Revell, 1979), we include inflation (i.e. consumer price

index) to control for this economic uncertainty.

3.5.4 Descriptive statistics

Table 3.2 presents the descriptive statistics of the variables used in this study. We have 1798 bank-year observations for 110 banks and a 21-year sample. The mean value of the Z-score is 3.3, implying that on average, return on assets (ROA) would have to fall by 3.3 times their standard deviation to wipe out bank equity. The mean volatility of return (σ_{ROA}) is 0.01. The mean value of conventional Lerner (i.e., C-Lerner) is 32% and efficiency-adjusted Lerner (i.e., E-Lerner) is 42%, indicating that banks are pricing their product on average 32% and 42% above the marginal costs, respectively. The mean of total assets is Rs. 140,139 million; the loan ratio is 43%; LLP is 2% and net interest margin is 4%.[44] The mean of income diversification is 17% where equity ratio is around 12%. Regarding macroeconomic control variables, the mean of GDP per capita is Rs. 61,715. The mean value of GDP growth rate volatility is 2.08, indicating serious fluctuations in the economic growth of India for the last two decades. To control for economic stability, inflation is used, which has a mean of 7.4%. To circumvent the issue of endogeneity between market power and stability, three instruments are used in the IV regression technique: business freedom, merger and lagged Lerner indices. The mean value of business freedom is 51.66% with a standard deviation of 6.45%.

Table 3.A1 reports the pairwise correlations and their significance levels among the independent variables used in this paper. Our first research question is whether market power is positively related to a bank's risk taking attitude; the significant positive correlation between Lerner indices and equity ratio is evidence to support the competition-

[44] Loan ratio is measured as performing loans divided by total assets. Performing loans is the difference of total loans and nonperforming loans. Therefore, few banks showed a negative loan ratio.

fragility hypothesis for India (see, for example Beck, De Jonghe and Schepens, 2013). The variance inflation factors (VIF) are computed for each of our model estimates. The average VIF never exceeds 3, indicating that multicollinearity is not a cause for concern in our results.[45]

3.6 Empirical results

First, we report the specification tests and results for the competition-fragility hypothesis based on the IV regression model in equation (3.1). Second, we report the treatment effects of the CDR system on bank stability based on difference-in-differences estimation in equation (3.2). Finally, we report the contingent effects of the CDR system with bank competition on stability based on difference-in-difference-in-differences estimation in equation (3.3).

3.6.1 Bank competition and stability

Table 3.3 reports the impact of competition on a bank's risk taking attitudes. Two different measures of risk indicators are employed as the dependent variables that proxy for stability of an individual bank: the distance to default measured by logarithm of Z-score (columns 1 and 2), and the negative of return volatility measured by the standard deviation of ROA (columns 3 and 4). For the latter case, we follow Beck, De Jonghe and Schepens (2013) and transform this dependent variable to make it directly proportional to banking stability (i.e., $Volatility = [-\log(\sigma_{ROA})]$. Before choosing which estimator to use for equation (3.1), we conduct an endogeneity test for the competition measures i.e., Lerner indices, which is reported at the bottom of Table 3.3. Under conditional homoscedasticity, this endogeneity test statistic is equivalent to a Hausman test statistic (Tabak, Fazio and

[45] VIF is equal to 1/ (1-r^2), where r^2 is from the regression of an independent variable on the rest of the independent variables (see Anginer, Demirgüç-Kunt and Zhu, 2014).

Cajueiro, 2012). In case of rejecting the null hypothesis of exogeneity, we employ the GMM estimator. In case we cannot reject the null hypothesis, we use the OLS fixed effects estimator. In both cases, we calculate heteroskedasticity and autocorrelation consistent (HAC) standard errors which are reported in square brackets. The relevance and validity of the instruments used for the Lerner indices are confirmed by the First Stage *F-test* (> 10) and Hansen's *J-test (>0.05)*, respectively. The goodness of fit of all regression models is confirmed by the Second Stage *F-test*.

Based on columns 1 and 2 of Table 3.3, we find that both C-Lerner and E-Lerner have a significant positive relationship with Z-score, indicating that a higher degree of bank pricing power is positively associated with individual bank soundness in India. Since the dependent variable is the natural logarithm of Z-score, we can interpret the effect of market power on stability as semi-elastic. The highly significant coefficient of the Lerner index has substantial economic importance, where a one standard deviation decrease in the E-Lerner (0.253) is concomitant with a fall in the Z-score of 70%. In the case of C-Lerner, a one standard deviation (0.179) reduction is equal to a 128% drop in the Z-score.

This result also corroborates with the additional risk measures used in this study. The negative of return volatility, in columns 3 and 4, is also positively related to both competition measures, suggesting an increase in market power associated with reduction in return volatility. These results lend support to the traditional view of the competition-fragility hypothesis that lower bank pricing power leads to bank fragility. The findings of this study are in line with existing literature that uses Lerner index as a proxy for competition measure (see, e.g., Berger, Klapper and Turk-Ariss, 2009; Beck, De Jonghe and Schepens, 2013; Fu, Lin and Molyneux, 2014).

3.6.2 The impact of deregulation on banking stability

After the first phase of deregulation in 1992, India initiated a second phase of

deregulation in order to augment financial stability. Various financial reforms were initiated to improve capital adequacy and to bring forth provisioning norms on a par with international best practice. Table 3.3 also reports the impact of deregulation dummy on the banking stability. It shows that after 1998, the stability of Indian banks improves significantly. This is in accordance with a recent study of Das and Kumbhakar (2012) who find a significant impact of second phase deregulation on efficiency and total factor productivity. They argue that the substantial increase in the capital adequacy ratio played a vital role in the improvement of efficiency.

3.6.3 The impact of CDR on banking stability

We examine the effect of CDR on bank stability employing a difference-in-differences approach. The results are reported in Table 3.4a and 3.4b. We start with a simple comparison of means of the dependent variables in Table 3.4a. We collapse the data (averages) to get two data points per bank; one for the pre-implementation and another for the post-implementation of member and non-member banks of CDR. We report the before-after results for the variable *Z-score* and *return volatility*. As can be seen, banking stability increased for both groups, but it increased 36.9% (*Z-score*) more in the member banks. A similar result can be seen for the *return volatility*. We next run ten different regressions using analogous dependent variables with both competition measures. In all regressions, we include bank fixed effects and year fixed effects to control for bank-specific heterogeneity and aggregate economic shocks, respectively. In column 1, we show the results of basic regression without using any controls. The positive and significant coefficient of CDR indicates that banking stability increased by 43.6% after the implementation of the CDR mechanism in India. In columns 2-3, we add all the control variables. We also find a positive and statistically significant result at the 10% level. We use negative volatility of return and it confirms our results that after implementation of the

CDR system, there is a significant improvement in risk-reduction.[46]

The results of the interaction between CDR and Lerner indices are reported in columns 4, 5 and 9, 10 of Table 3.4b. For column 5, we find a significant negative interaction effect (-0.926) on stability. The evidence suggests that the magnitude of the positive impact of CDR on stability diminishes for the member banks at a higher degree of market power. In terms of economic magnitudes, it implies that a one standard deviation reduction in market power (0.253) leads to a 23% increase in the soundness of member banks. This finding is corroborated by the significant negative coefficient (-0.776) of the interaction terms in column 10. It should be noted that, in the case of multiplicative terms in the models, based on simple t-statistics we cannot make accurate inference because the model parameter does not provide adequate information (Brambor, Clark and Golder, 2006). Therefore, following Brambor, Clark and Golder (2006), we use marginal effect to show the influence of different levels of market power (competition) on the impact of CDR on stability.

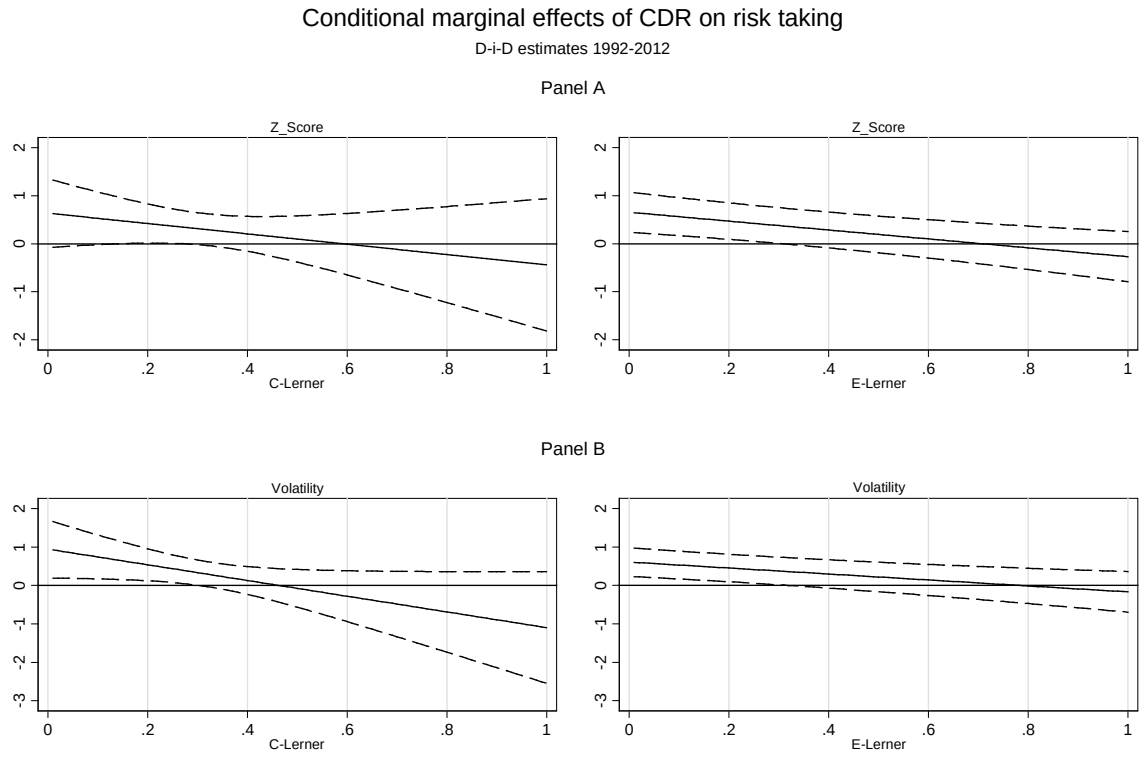
The estimated total marginal effects and standard errors of CDR on stability are graphically illustrated in Figure 3.3. The upper (lower) panel, Panel A (Panel B) shows the total effect of CDR on Z-score (negative return volatility) for both conventional and efficiency-adjusted Lerner indices (i.e. C-Lerner and E-Lerner). The marginal effect of CDR on the Z-score is statistically different from zero before a threshold level of E-Lerner Index of around 38 points, with stability loss of up to 9% at higher market power levels. In other words, the positive impact of restructuring of corporate loans diminishes as market

[46] In DID, the same firm is observed before and after a program, in doing so, we are cancelling out (or controlling for) both the effect of observed time-invariant characteristics as well as the effect of unobserved time-invariant characteristics (see Gertler, Martinez, Premand, Rawlings and Vermeersch, 2011, p99). For example: the SARFAESI Act 2002 strengthened the rights of secured creditors and may have had some effect on the stability of banks. Since this legal reform happened at the country level and applied to all banks in India, we assume that this time-invariant characteristic does not have any influence on the DID effect in this study (see Vig, 2013, for details on SARFAESI Act). However, we check the sensitivity of our results using a dummy of the SARFAESI Act (taking a value equal to one for the year 2002 and thereafter, or else zero), and the results (unreported) remain unaltered.

power increases, and this effect on Z-score becomes insignificant once E-Lerner index reaches beyond 38 points.

Figure 3.3

Marginal effect of CDR on banking stability



Note that it corresponds with our results in Table 3.4b. The graphs on the upper panel display the marginal effect of CDR on Z-score at different levels of market power i.e., C-Lerner (left) and E-Lerner (right). It shows that the positive impact of CDR diminishes as market power increases with a loss of Z-score at 9%. The graphs on the lower panel display the marginal effect of CDR on negative return volatility at different levels of market power i.e., C-Lerner (left) and E-Lerner (right).). It shows that the positive impact of CDR diminishes as market power increases with a loss of volatility at 5%.

We find similar results from column 10 that the marginal effect of CDR on negative return volatility is statistically different from zero before a threshold level of efficiency-adjusted Lerner Index of around 39 points, with loss of stability of up to 5% at higher market power levels. Caminal and Matutes (2002) show that banks with greater market power tend to incur higher monitoring costs and have risky loan portfolios.

Therefore, the probable explanation of our finding is that member banks may have shown delinquency in determining the riskiness of their portfolios. It could also be that the de jure implementation of the CDR system and benefit through regulatory forbearance on asset classification and provisioning de facto impacted the margin of the member banks and hence market power (see Figure A3.1); as a result, they could get some extra leeway taking excessive risk which resulted in the diminishing benefits of CDR on stability. This favorable effect of CDR on the performance of the Indian banking sector remains consistent with the increasing efficiency change after 2002 reported in Sahoo and Tone (2009), across all ownership groups.

3.6.4 Sensitivity analysis

It is possible that the relationship between market power and stability is due to poorly specified Lerner indices. According to Maudos and de Guevara (2007), the estimated MC_{it} through equation (3.7), may be prone to some form of monopoly power originating from deposit markets due to the bank's ability to fund at a cheaper rate. Since a form of deposit market power is already reflected in the loan pricing, including the factor funding cost in equation (3.6) may provide biased results. Therefore, to eliminate the deposit market distortions we re-specified equation (3.6) with only two factors (i.e., cost of labour and cost of capital) and calculated marginal costs (MC_{it}) for bank i at time t following equation (3.7). This Lerner index, which is a 'raw' pricing power of an individual bank, is then derived from the structural model specified in equation (3.5). Table 3.A2 shows results of the funding-adjusted Lerner index and risk-taking attitudes. We also use ex-post credit risk as a risk indicator and the results remain unaltered, supporting the competition-fragility hypothesis.

To check the sensitivity of these results we also construct three different market power dummy variables for the different level of market power of banks following Tabak,

Fazio and Cajueiro (2012). These dummies are High ($\geq \overline{\text{Lerner}}+0.5\sigma_{\text{Lerner}}$), Average ($<\overline{\text{Lerner}}+0.5\sigma_{\text{Lerner}}$ and $>\overline{\text{Lerner}}-0.5\sigma_{\text{Lerner}}$), and Low ($\leq \overline{\text{Lerner}}-0.5\sigma_{\text{Lerner}}$). Since we have different variants of Lerner indices i.e. C-Lerner and E-Lerner, six market power dummies are created in order to check the impact of different levels of market power on stability. The results are reported in Table 3.5. Based on the results of market power dummy we can see that High and Average market power dummies of both Lerner indices are positively and significantly related with Z-score. However, the Low market power dummy is always negatively and significantly associated with Z-score. Similar results are obtained when we use the negative return volatility as the dependent variable. These results suggest that banks with less market power (i.e. <29 points) are likely to take more risk. In other words, banks operating with higher competition are likely to adopt more aggressive risk-taking attitudes. These findings lend support to our earlier results that greater competition enhances risk-taking behaviours, alluding to the competition-fragility hypothesis.[47]

To alleviate any selection bias, that might yet remain in our DID result, we use propensity score matching (PSM) (see Rosenbaum and Rubin, 1983). This matching technique allows us to identify a group of non-member banks which are similar to the member banks on the basis of some observable characteristics, and then compare the banking stability between the control and treated groups. By doing this, it can avoid any selection bias and provide unbiased estimates of treatment effects (Abadie and Imbens, 2006; Imbens and Wooldridge, 2009). In the first stage of PSM, we estimate the probability (i.e., propensity score) that a bank enters into the CDR mechanism by using a logit model (see Table 3.A3). In the second stage, we match each member bank of CDR with non-

[47] In addition, a possible nonlinear relationship between competition and financial stability is also captured by using the quadratic term for the Lerner indices following Berger, Klapper and Turk-Ariss (2009). The unreported results based on the calculated inflection points remain unchanged.

member banks with a similar propensity score. For this procedure, we consider two matching techniques that include kernel marching and stratified matching. Furthermore, following Abadie and Imbens (2006), we also estimate the average treatment effect using the bias-corrected covariate matching estimator adjusted for heteroskedasticity, matching on four nearest neighbours as recommended in Abadie, Drukker, Herr and Imbens (2004). Unlike PSM, this method uses covariates to match the treatment group and control group, corrects for bias when matching is not perfect, makes no assumption about functional form, and provides standard errors for matching estimators. The results are reported in Table 3.6, and are consistent with the earlier findings. In all matching estimators, the average treatment effect for the treated (ATT) remains significant at the 1% level, indicating a significant improvement in the stability of member banks of CDR.

3.7 Conclusions and policy implications

Following widespread corporate distress in servicing debt obligations to the creditors, the Reserve Bank of India implemented a debt restructuring programme in the form of 'corporate debt restructuring' in 2002. This institutional mechanism was intended to mitigate debt overhang of corporates and NPLs overhang of banks. In this paper, we contribute to the literature on debt restructuring from the creditors' perspective by investigating the impact of the CDR system on bank stability. We exploit the membership variation of banks of the CDR programme to find the causal relations of the treated banks on stability while using a 'natural experiment' type difference-in-differences (DID) approach. To eliminate any sample selection bias, we deploy a number of matching estimators including the recently developed bias-corrected covariate matching estimator proposed by Abadie and Imbens (2006). Despite the Indian banking sector having undergone multiple financial reforms and structural changes in the last two decades, studies on the effects of such changes in the context of India is inadequate and mostly

limited to productivity and efficiency analyses (e.g., Fujii, Managi and Matousek, 2014; Tzeremes, 2015). Therefore, drawing bank-level data from an important emerging market, we have also complemented the existing literature on the *market power-stability* nexus by using a sample period (i.e., 1992-2012) that has observed a number of financial reforms including the consolidation and liberalisation process.

The balance of evidence suggests that market power, proxied by two variants of Lerner indices i.e. conventional and efficiency-adjusted Lerner indices, enhances the stability of Indian banks where greater competition induces excessive risk-taking of individual banks, supporting the competition-fragility relationship. It also appears that although the second phase of deregulation improved overall banking stability significantly, there is a threshold level of market power below which banks experience a higher risk of fragility. The result from the DID approach suggests that after the genesis of CDR, member banks with generous regulatory forbearance on asset classification and provisioning experience an improvement in stability. It indicates that the soundness of member banks increased by 43.6% after the implementation of the CDR mechanism. The findings of the matching estimators are also consistent with the result of the DID approach and show a positive treatment effect of CDR. This finding on the causal relationships point to a channel through which timely and efficient out-of-court restructuring mechanism with minimum regulatory forbearance can have a positive impact on banking stability. However, the finding of the interactive effect is alarming for the regulator as the marginal effect of CDR on Z-score is statistically different from zero before a threshold level of E-Lerner Index of around 38 points, with stability loss of up to 9% at a higher degree of market power. As member banks were able to gain market power substantially (21%)[48] due to generous regulatory forbearance, it might have provided them some extra leeway to show

[48] Based on preliminary data analysis, we find that the average E-Lerner of member banks for the post-CDR period has increased to 41 points compared to 34 in the Pre-CDR period (see Figure 3.A1).

delinquency in determining the riskiness of their portfolios (see Caminal and Matutes, 2002).

The findings of this paper have policy implications for the central bank of India–RBI and bank managers for improving credit quality and stability: (i) based on the overall results, it seems that RBI's intention of having a stable banking sector has largely been achieved in the short-run as creditors were able to get respite from high provisioning on the restructured corporate loans, and hence increased their stability. However, the recent up-trend in restructuring corporate debt is worrisome and therefore, regulators should tighten the macroprudential norms and emphasise international best practice in asset classification and provisioning of restructured corporate loans, ensuring there is no scope for ever-greening (Peek and Rosengren, 1995); (ii) since it is predicted that at least 20-30% of restructured standard corporate loans will slip into sub-standard loans eventually (WG, 2012), bank managers should increase provisioning on existing restructured loans gradually, otherwise any substantial losses might lead them to exhaust the capital base at a point where insolvency or illiquidity would be inevitable; and (iii) as most of the state-owned banks participated in the CDR programme, it is natural that they would be affected more in the event of more restructured corporate loans becoming bad eventually. The reason being is that due to the CDR mechanism they were able to understate the actual state of their risk-weighted assets, and hence keep the required capital. Therefore, in the long-run, to have a more stable banking sector, the Indian government should either inject more capital in these banks at the expense of taxpayers or take a more sane approach and raise some funds by selling the majority shareholdings to private investors.

The finding of this study also has policy implications for some emerging market economies, especially for Brazil. Recently, many Brazilian firms have been facing difficulties paying back debt to their creditors partly due to high interest rates and currency

devaluation.[49] Therefore, to reduce the debt overhang of Brazilian firms, the Central Bank of Brazil (i.e., Banco Central do Brasil) can adopt a similar approach to the *CDR* mechanism with reasonable regulatory forbearance in order for the creditors to get some respite from accumulating bad debts while also making sure that viable corporates can forestall bankruptcy.

[49] Lucchesi, C. and Levin, L., "Evercore, Rothschild Hiring for Brazil Debt-Restructuring Wave", November 2015 http://www.bloomberg.com/news/articles/2015-09-03/evercore-rothschild-hiring-for-brazil-debt-restructuring-wave

Table 3.1

Variable Definitions and Sources

Variables	Notation	Definitions	Source
Frontier Arguments			
Costs of funds	w1	Sum of interest expenses on deposits, interest expenses on RBI and inter-bank funds divided by sum of deposits and borrowings from RBI and others	RBI
Cost of labour	w2	Payments to and provisions for employees divided by total assets	RBI
Cost of capital	w3	Other operating expenses divided by fixed assets	RBI
Total loans	y1	Total loans and advances	RBI
Other earning assets	y2	Total investments	RBI
Equity	z	Sum of capital and reserves and surplus	RBI
Operating costs	TOC	Sum of Interest Expenses and Operating Expenses	RBI
Profit before tax	PBT	Operating income less TOC	RBI
Negative profit	NPI	Takes 1 for the negative profit or else 0	Own
Bank risk measures			
Z-score	Z-score	Sum of return-on-assets (ROA), defined as net profit over assets, and equity ratio (EQA), defined as equity over assets, divided by standard deviation of (ROA) of each bank over past three years (calculated using a rolling window)	Own
Return Volatility	Sd(ROA)	Standard deviation of ROA for each bank, calculated over past 3 years	Own
Credit risk	NPL	Non-performing loans divided by total loans	RBI
Market Power			
C-Lerner	C-Lerner	A bank-level non-structural indicator of bank competition, measured by using fixed-effects method, with lower values indicating higher competition in the banking sector	Own
E-Lerner	E-Lerner	A bank-level non-structural indicator of bank competition, an efficiency-adjusted Lerner index, measured by using a stochastic frontier analysis approach, with lower values indicating higher competition in the banking sector	Own
Bank characteristics			
Bank Size	Size	Logarithm of total assets	RBI
Loan ratio	Loan	Total performing loans divided by total assets	RBI
Provision ratio	LLP	Total loan loss provision divided by total assets	RBI
Net interest margin	NIM	Net interest income to total earning assets	RBI
Income	DIV	Non-interest income divided by total operating income	RBI
Equity ratio	EQA	Total equity divided by total assets	RBI
IV Instruments			
Merger	Merger	Takes value equal to one for the year and thereafter if a bank enters into mergers and acquisitions activity or else zero	Own
Business Freedom	BusFree	The business freedom is taken from Heritage Foundation, it is a number between 0 and 100, with 100 equaling the freest business environment	HF
Macroeconomic variables			
GDP per capita	GDP	Logarithm of GDP per capita	WDI
Volatility of GDP	sd(GDP)	Standard Deviation of real GDP growth rate calculated over past five years using a rolling window	WDI
Inflation	INF	Annual growth rate of consumer price index	WDI

Note: RBI, HF and WDI stand for the Reserve Bank of India, the Heritage Foundation and the World Development Indicator, respectively. Own stands for author's own calculation.

Table 3.2

Summary Statistics

This table shows the total sample summary statistics for the bank-specific variables, macroeconomic variables and the variables that are used as instruments in the instrumental variable regressions throughout the paper. Bank-level data is compiled from the RBI, from the Reports on trend and Progress of Banking in India for various years. Macroeconomic data is retrieved from the World Bank World Development Indicator (WDI). The IV instrument business freedom is obtained from the Economic Freedom Indicators of Heritage Foundation (2013). The full sample contains 1798 observations. This table consists of six parts. The descriptive statistics of the variables used for translog costs function is in the first part. The dependent variables which are used to proxy for stability of individual banks are in the second part of this table. The third part contains market power variables, which is proxied by two variants of Lerner indices: conventional Lerner (i.e., C-Lerner) and efficiency-adjusted Lerner (i.e., E-Lerner). Bank-specific variables are in the fourth part. IV instruments are in the fifth part of this table followed by the macroeconomic variables in the sixth.

Variable	Mean	Median	SD	Min	Max	N
Frontier Arguments						
Costs of funds	0.07	0.06	0.15	0	6.3	1798
Costs of labour	0.01	0.01	0.01	0	0.13	1798
Costs of capital	0.64	0.33	1.18	0.01	15.58	1798
Total loans	73096	14129	193917	0.3	2967979	1798
Other earning assets	43712	11073	102235	3	1207346	1798
Operating costs	9875	2598	22804	6	305492	1798
Profits before tax	2775	556	7024	-4422	108013	1798
Equity	9067	2034	22475	5	287196	1798
Total revenue	12650	3369	29558	4	413505	1798
Dependent Variables						
Z-score	3.3	3.29	1.18	-3.84	7.68	1572
Volatility of ROA	0.01	0	0.01	0	0.16	1578
Credit risk	0.05	0.02	0.08	-0.45	1.22	1792
Market Power						
C-Lerner	0.32	0.3	0.18	-1.99	0.9	1798
E-Lerner	0.42	0.44	0.25	-2.21	0.97	1798
Bank-specific variables						
Total asset	140139	31628	342239	106	4568799	1798
Loan ratio	0.43	0.44	0.14	-0.03	0.82	1792
LLP ratio	0.02	0.01	0.02	-0.23	0.28	1786
NIM	0.04	0.04	0.04	-0.41	0.58	1798
Diversification	0.17	0.14	0.13	-1.66	0.87	1798
Equity ratio	0.12	0.07	0.15	0	0.98	1798
Reregulation	0.73	1	0.45	0	1	1798
CDR	0.24	0	0.43	0	1	1798
IV Instruments						
Merger	0.09	0	0.29	0	1	1798
Business Freedom	51.66	55	6.45	35.5	55	1650
Macroeconomic variables						
GDP per capita	61715	36189	61301	7093	236651	1798
Volatility of GDP	2.08	2.03	0.53	0.88	3.07	1798
Inflation	7.4	7.16	3.07	3.68	13.23	1798

Table 3.3

The effect of bank competition on stability

The dependent variable is the Z-score, reported in columns 1and 2, standard deviation of return on assets, reported in columns 3 and 4. Bank competition is proxied by two variants of the Lerner indices i.e., conventional Lerner (C-Lerner) and efficiency-adjusted Lerner (E-Lerner). De-regulation dummy takes one for the year 1998 and thereafter and otherwise zero. Bank size is the logarithm of total assets valued in million rupees. Bank's liquidity is proxied by the ratio of net loan over assets. LLP ratio is measured as loan loss provision as a percentage of total assets, where income diversification is the ratio of non-interest income over total income. The profitability measure NIM is measured as the net interest income over total earning assets. Banks' equity is the bank total equity to asset ratio. To control for economic development, logarithm of GDP per capita is used, and volatility of GDP growth rate, measured as the standard deviation of GDP growth rate using 5-year rolling window, is used to account for precariousness of business cycle for the last two decades. Inflation is used to capture the economic uncertainty. Before deciding which estimator to apply, we run an endogeneity test for the Lerner indices; if we reject the null hypothesis of exogeneity, we use GMM estimator, or else use OLS fixed effects estimator. In both cases, we consider heteroskedasticity-autocorrelation robust standard errors (HAC). ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Source: RBI and WDI. Coverage: 1992-2012.

	1	2	3	4
VARIABLES	Z-score [log(ROA+EQA)/(sd(ROA)]		Return volatility [-log(sd(ROA))]	
C-Lerner	7.145***	-	5.371***	-
	[1.338]	-	[1.271]	-
E-Lerner	-	2.783***	-	1.846***
	-	[0.640]	-	[0.531]
Deregulation	3.652***	1.567	3.209***	1.662
	[1.083]	[1.109]	[1.080]	[1.066]
Size	0.170**	0.162*	0.215***	0.223***
	[0.079]	[0.084]	[0.075]	[0.075]
Loan ratio	2.794***	1.050**	2.472***	1.333***
	[0.358]	[0.410]	[0.324]	[0.367]
LLP ratio	-21.546***	-12.256***	-17.346***	-10.930***
	[3.708]	[2.935]	[3.882]	[1.903]
Diversification	-3.400***	0.238	-2.495***	0.355
	[0.955]	[0.488]	[0.897]	[0.431]
NIM	-8.433***	0.185	-6.040**	0.720
	[3.006]	[1.193]	[2.678]	[1.025]
Equity ratio	0.891	-1.019	-1.989***	-3.201***
	[0.601]	[0.755]	[0.574]	[0.673]
GDP Per Capita	-2.510***	-0.588	-2.174***	-0.769
	[0.778]	[0.790]	[0.777]	[0.764]
Volatility of GDP	1.931***	0.085	1.578**	0.231
	[0.691]	[0.714]	[0.690]	[0.690]
Inflation	-0.035	-0.008	-0.038	-0.018
	[0.047]	[0.047]	[0.046]	[0.045]
Diagnostic Test				
Estimator	GMM	GMM	GMM	GMM
First Stage F-test	10.54***	35.81***	11.23***	38.60***
Hansen's J Chi2	0.834	0.0330	1.607	0.317
Hansen's J [p-value]	0.361	0.856	0.205	0.573
Second Stage F-test	15.31***	13.03***	9.428***	9.980***
No. of Obs.	1,561	1,561	1,566	1,566
No. of banks	106	106	106	106

Table 3.4a

Basic empirical strategy

Member banks are those who participated and Non-member banks are those who did not participate in the CDR programme. 'Before' refers to 1992-2003 and 'After' refers to the period from 2004 to 2012. DID refers to Difference-in-Differences. Diff is interpreted as the percentage change form period before to after. DID is the percentage change in the member banks compared to non-member banks. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Outcome variable	**Before**			**After**			
	Non-Member	Member	Diff	Non-Member	Member	Diff	**DID**
Z-Score	2.881	3.079	0.197***	3.407	3.973	0.566***	**0.369*** **
Std. Error	0.051	0.057	0.076	0.059	0.058	0.083	**0.113**
Return volatility	5.218	5.984	0.766***	5.156	6.671	1.516***	**0.75*** **
Std. Error	0.05	0.056	0.075	0.058	0.058	0.082	**0.111**

Table 3.4b
The effect of corporate debt restructuring (CDR) on bank Stability

This table reports results from the regression $Bank\ risk_{it} = \alpha_0 + \alpha_t + \beta_1 \cdot (CDR)_{it} + \beta_2 Lerner_{i,t} + \sum \gamma \cdot (Controls)_{it} + \sum \delta \cdot (Macro)_{it} + \varepsilon_{it}$ And $Bank\ risk_{it} = \alpha_0 + \alpha_t + \beta_1 \cdot (CDR)_{it} + \beta_2 Lerner_{i,t} + \beta_3 \cdot (CDR)_{it} \times (Lerner_{i,t}) + \sum \gamma \cdot (Controls)_{it} + \sum \delta \cdot (Macro)_{it} + \varepsilon_{it}$. The dependent variable is the Z-score, reported in columns 1-5, standard deviation of return-on-assets, reported in columns 6-10. Following Beck et al. (2013) we transform the latter to interpret it as an indicator of financial stability. Here, CDR is an indicator variable equal to one in the year and thereafter when bank i enters an inter-creditor agreement to pursue restructuring of corporate debt (i.e., treated group) and otherwise zero (i.e., control group). $Lerner_{it}$ is either conventional Lerner (i.e., C-Lerner) or efficiency-adjusted Lerner (i.e., E-Lerner) for bank i at time t. The variable of interest is β_1 and β_3 where the former captures the difference-in-differences (DID) effect and the latter captures the difference-in-difference-in-differences (DDD) effects. Bank-level and macroeconomic control variables are included in both equations. We clustered standard error at bank-level and reported it in square brackets. ***, **, and * implies significance at the 1%, 5%, and 10%, levels respectively. Source: RBI and WDI. Coverage: 1992-2012.

	Z-score [log(ROA+EQA)/(sd(ROA)]					Return volatility [-log(sd(ROA))]				
VARIABLES	1	2	3	4	5	6	7	8	9	10
CDR	0.436**	0.322*	0.312*	0.638*	0.657***	0.682***	0.346**	0.318*	0.947**	0.608***
	[0.183]	[0.170]	[0.188]	[0.365]	[0.213]	[0.172]	[0.171]	[0.186]	[0.384]	[0.191]
C-Lerner		2.647***		2.723***			1.687***		1.797***	
		[0.305]		[0.314]			[0.222]		[0.240]	
E-Lerner			1.085***		1.307***			0.709***		0.888***
			[0.214]		[0.181]			[0.167]		[0.162]
CDR x C-Lerner				-1.077					-2.043*	
				[1.006]					[1.067]	
CDR x E-Lerner					-0.926***					-0.776***
					[0.285]					[0.254]
Size		0.094	0.126	0.092	0.123		0.154	0.182*	0.150	0.178*
		[0.087]	[0.090]	[0.086]	[0.091]		[0.093]	[0.097]	[0.093]	[0.097]
Loan ratio		1.853***	1.504***	1.826***	1.462***		1.714***	1.563***	1.657***	1.522***
		[0.367]	[0.377]	[0.368]	[0.379]		[0.346]	[0.365]	[0.343]	[0.363]
Loan Loss Provision		-10.176*	-8.429	-10.226*	-8.595		-10.218**	-9.205*	-10.273**	-9.291**
		[5.522]	[6.172]	[5.519]	[6.106]		[4.272]	[4.712]	[4.249]	[4.636]
Diversification		0.059	0.753	0.070	0.686		0.306	0.728	0.337	0.672
		[0.410]	[0.490]	[0.405]	[0.492]		[0.425]	[0.469]	[0.422]	[0.470]
Net interest margin		-0.131	1.307	-0.096	1.157		0.517	1.552	0.600	1.413
		[1.137]	[1.627]	[1.134]	[1.555]		[1.167]	[1.462]	[1.171]	[1.398]
Equity ratio		1.111*	0.846	1.100*	0.771		-1.821***	-1.968***	-1.840***	-2.030***
		[0.623]	[0.717]	[0.628]	[0.704]		[0.589]	[0.655]	[0.588]	[0.649]
GDP per capita		-0.066	0.010	-0.072	0.008		-0.174	-0.131	-0.184	-0.130
		[0.133]	[0.134]	[0.134]	[0.133]		[0.119]	[0.119]	[0.119]	[0.118]
Volatility of GDP		0.146*	0.081	0.141*	0.102		0.191**	0.149**	0.180**	0.166**
		[0.077]	[0.075]	[0.077]	[0.074]		[0.073]	[0.072]	[0.073]	[0.071]
Inflation		-0.015	-0.024*	-0.016	-0.025*		-0.028**	-0.034**	-0.029**	-0.034**
		[0.014]	[0.014]	[0.014]	[0.014]		[0.013]	[0.013]	[0.013]	[0.013]
Constant	3.730***	1.244	0.651	1.333	0.629	5.779***	4.828***	4.394***	4.992***	4.375***
	[0.143]	[1.099]	[1.205]	[1.111]	[1.208]	[0.120]	[1.015]	[1.102]	[1.018]	[1.107]
Diagnostic Test										
Observations	1,569	1,564	1,564	1,564	1,564	1,574	1,569	1,569	1,569	1,569
No. of banks	110	109	109	109	109	110	109	109	109	109
Bank fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Adj. R^2	0.188	0.281	0.246	0.282	0.251	0.121	0.218	0.191	0.221	0.195
F	14.15***	22.03***	18.12***	23.56***	19.03***	9.487***	12.52***	10.50***	14.44***	10.98***

Table 3.5

The relationship between different levels of bank competition and stability

To check the sensitivity of the earlier results that higher market power is congenial to reducing risk we have constructed three different levels of market power dummies following Tabak et al. (2012) for High ($\geq \overline{\text{Lerner}}+0.5\sigma_{\text{Lerner}}$), Average ($<\overline{\text{Lerner}}+0.5\sigma_{\text{Lerner}}$ and $>\overline{\text{Lerner}}-0.5\sigma_{\text{Lerner}}$), and Low ($\leq \overline{\text{Lerner}}-0.5\sigma_{\text{Lerner}}$). Six market power dummies of C-Lerner and E-Lerner are regressed with Z-score and return volatility. Bank fixed effects and year fixed effects are included in all regressions. Unreported bank controls and macro controls are also included in all regressions. Result shows that only banks with Low level of market power are negatively associated with banking stability. Source: RBI and WDI. Coverage: 1992-2012.

	Z-score [(ROA+EQA)/(sd(ROA)]						Return volatility [-log(sd(ROA))]					
VARIABLES	1	2	3	4	5	6	7	8	9	10	11	12
High C-Lerner	1.064***						0.218**					
	[0.324]						[0.105]					
Average C-Lerner		0.990***						0.977***				
		[0.220]						[0.211]				
Low C-Lerner			-1.626***						-1.305***			
			[0.238]						[0.217]			
High E-Lerner				0.722**						0.074		
				[0.284]						[0.076]		
Average E-Lerner					0.451**						0.306*	
					[0.200]						[0.180]	
Low E-Lerner						-1.068***						-0.600***
						[0.250]						[0.228]
Deregulation	2.167**	3.006***	3.481***	1.312	2.676**	2.015*	2.066**	2.888**	3.124***	1.979*	2.390**	1.968*
	[1.029]	[1.150]	[1.247]	[1.113]	[1.081]	[1.089]	[1.025]	[1.149]	[1.184]	[1.034]	[1.050]	[1.043]
Diagnostic Test												
Estimator	GMM	GMM	GMM	GMM	GMM	GMM	OLS	GMM	GMM	OLS	GMM	GMM
Bank controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Macro controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
First Stage F-test	24.89***	47.90***	57.70***	27.89***	60.79***	57.93***		47.70***	58.62***		60.73***	57.78***
Hansen's J Chi2	0.36	0.378	0.126	0.64	0.129	0.00168		1.154	0.65		0.962	0.619
Hansen's J [p-value]	0.548	0.538	0.722	0.424	0.72	0.967		0.283	0.42		0.327	0.431
Second Stage F-test	12.87***	11.80***	13.45***	12.43***	11.85***	12.37***	8.524***	8.530***	9.515***	8.390***	8.912***	9.209***
Adj. r2	0.136	0.083	0.078	0.134	0.134	0.092	0.113	0.014	0.046	0.110	0.095	0.080
No. of Obs.	1,561	1,561	1,561	1,561	1,561	1,561	1,569	1,566	1,566	1,569	1,566	1,566
No. of banks	106	106	106	106	106	106	106	106	106	106	106	106

Table 3.6

Sensitivity analysis of the impact of CDR using matching techniques

VARIABLES	Z-score [(ROA+EQA)/(sd(ROA)]			Return volatility [-log(sd(ROA))]		
Matching estimators	Kernel matching	Stratified Matching	Abadie and Imbens	Kernel matching	Stratified Matching	Abadie and Imbens
ATT	0.58**	0.48**	0.84**	0.57**	0.45**	0.70**
SE	[0.08]	[0.09]	[0.13]	[0.09]	[0.09]	[0.13]
t-statistics	7.04	5.13	6.59	6.18	4.94	5.19
Observations	1,403	1,403	1,240	1,403	1,403	1,241
Common support condition	√	√	√	√	√	√

Note: Three matching methods are used: Kernel matching, Stratified matching and the nearest-neighbour bias-corrected matching estimators proposed by Abadie and Imbens (2006). Abadie and Imbens' method adjusts the differences within the matches for the differences in covariate values. Following Abadie et al. (2004), we use four matches per observation. The variables that are used for the matching (or bias-adjusted variables) include the age of the bank, listed bank dummy (equal to one if a bank is listed in the stock market, or else zero), the number of employees, the number of branches and the logarithm of total assets. ATT is the average treatment effect for the treated. The standard errors in Abadie and Imbens are heteroskedasticity-consistent, and *Z*-stats are reported. For the rest, we report absolute values of bootstrapped *t*-stats in brackets. Observation size is reduced as we do not have information on the number of employees for all banks prior to 1997. The number of observations also differs due to the difference in the underlying matching approaches. We run balancing test on all the independent variables included in the logit regression which have been satisfied. Hosmer–Lemeshow test confirmed goodness-of-fit of the logit model (unreported but available upon request).

Appendix 3.A

Table 3.A1

Correlation table

This table provides information on the correlation between the market power, bank-specific and macroeconomic variables used throughout the paper. It contains pairwise correlation coefficients and the indication of their significance in the correlation.

		1	2	3	4	5	6	7	8	9	10	11
C-Lerner	1	1										
E-Lerner	2	0.56***	1									
Size	3	-0.32***	-0.22***	1								
Loan ratio	4	-0.13***	0.12***	0.35***	1							
LLP ratio	5	0.28***	0.19***	-0.20***	-0.08***	1						
NIM	6	0.42***	0.32***	-0.42***	-0.26***	0.22***	1					
Diversification	7	0.54***	0.30***	-0.21***	-0.20***	0.10***	0.10***	1				
Equity ratio	8	0.35***	0.37***	-0.53***	-0.24***	0.13***	0.52***	0.31***	1			
Per Cap. GDP	9	0.10***	0.13***	0.28***	0.27***	-0.12***	-0.15***	0.19***	0.20***	1		
GDP Volatility	10	0.08**	0.13***	0.12***	0.15***	-0.02	-0.06*	0.03	-0.01	0.28***	1	
Inflation	11	0.02	0.19***	0.03	0.16***	-0.01	0.03	-0.06*	-0.04	0	0.26***	1

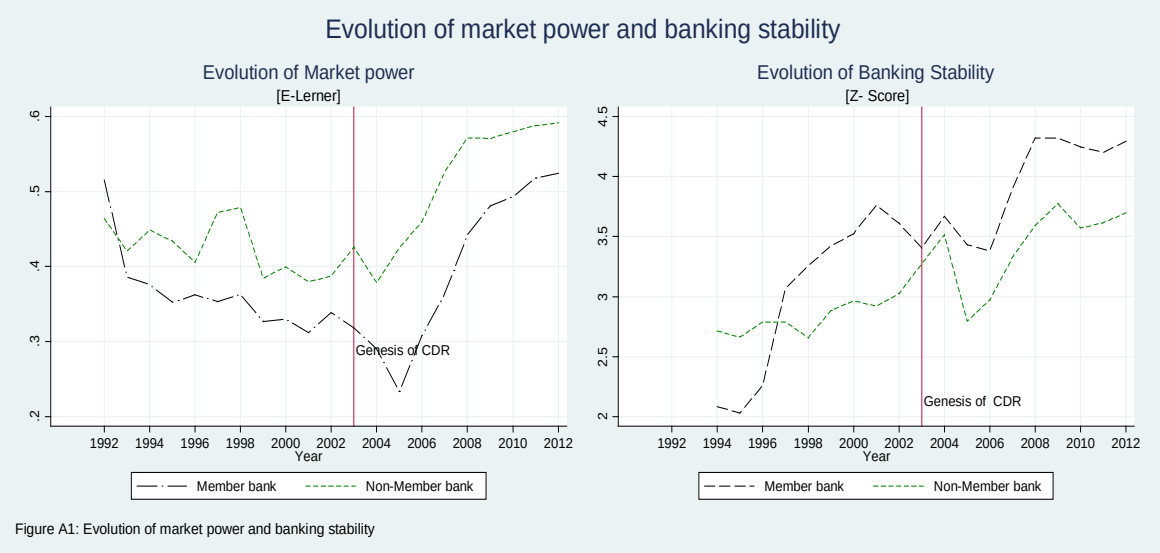
Table 3.A2

Competition-Fragility: Fund-adjusted Lerner with 1% outlier correction

The dependent variable is the Z-score, reported in columns 1, 2 and 3; standard deviation of return on assets, reported in columns 3, 4 and 5; and nonperforming loans are reported in 7, 8 and 9. Bank competition is proxied by three variants of the Lerner indices i.e., conventional Lerner (C-Lerner), efficiency-adjusted Lerner (E-Lerner) and funding-adjusted Lerner (F-Lerner). De-regulation dummy takes one for the year 1998 and thereafter and otherwise zero. Bank size is the logarithm of total assets valued in million rupees. Bank's liquidity is proxied by the ratio of net loan over assets. LLP ratio is measured as loan loss provision as a percentage of total assets, where income diversification is the ratio of non-interest income over total income. The profitability measure NIM is measured as the net interest income over total earning assets. Banks' equity is the bank total equity to asset ratio. To control for economic development, logarithm of GDP per capita is used, and volatility of GDP growth rate, measured as the standard deviation of GDP growth rate using 5-year rolling window, is used to account for precariousness of business cycle for the last two decades. Inflation is used to capture the economic uncertainty. Before deciding which estimator to apply, we run an endogeneity test for the Lerner indices; if we reject the null hypothesis of exogeneity, we use a GMM estimator, or else use OLS fixed effects estimator. In both cases, we consider heteroskedasticity-autocorrelation robust standard errors (HAC). ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Source: RBI and WDI. Coverage: 1992-2012.

	1	2	3	4	5	6	7	8	9
VARIABLES	Z-score [(ROA+EQA)/(sd(ROA)]			Return volatility [-log(sd(ROA))]			NPL [log(NPL)]		
C-Lerner	6.195***			4.247***			-2.276***		
	[0.735]			[0.663]			[0.517]		
E-Lerner		2.905***			1.663***			-0.384	
		[0.546]			[0.478]			[0.247]	
F-Lerner			6.256***			4.396***			-1.836***
			[0.675]			[0.621]			[0.478]
Deregulation	3.571***	1.576	2.690***	3.075***	1.755*	2.490**	-1.685***	-1.567***	-1.590***
	[1.025]	[1.090]	[0.982]	[1.022]	[1.048]	[0.987]	[0.427]	[0.433]	[0.424]
Diagnostic Test Estimator	GMM	GMM	GMM	GMM	GMM	GMM	FE	FE	FE
First Stage F-test	84.95***	45.65***	85.87***	84.64***	46.37***	84.59***	-	-	-
Hansen's J Chi2	0.661	0.0591	1.530	0.964	0.539	1.666	-	-	-
Hansen's J [p-value]	0.416	0.808	0.216	0.326	0.463	0.197	-	-	-
Second Stage F-test	16.42***	13.68***	17.32***	10.56***	9.848***	11.29***	54.32***	51.80***	54.62***
Adj. r2	0.218	0.142	0.237	0.148	0.107	0.160	0.469	0.454	0.465
No. of Obs.	1,561	1,561	1,561	1,566	1,566	1,566	1,567	1,567	1,567
No. of banks	106	106	106	106	106	106	105	105	105

Figure 3.A1
Evolution of market power and banking stability



Note: figure on the left (right) shows that after the implementation of corporate debt restructuring mechanism in India, member banks increase market power (bank stability) substantially.

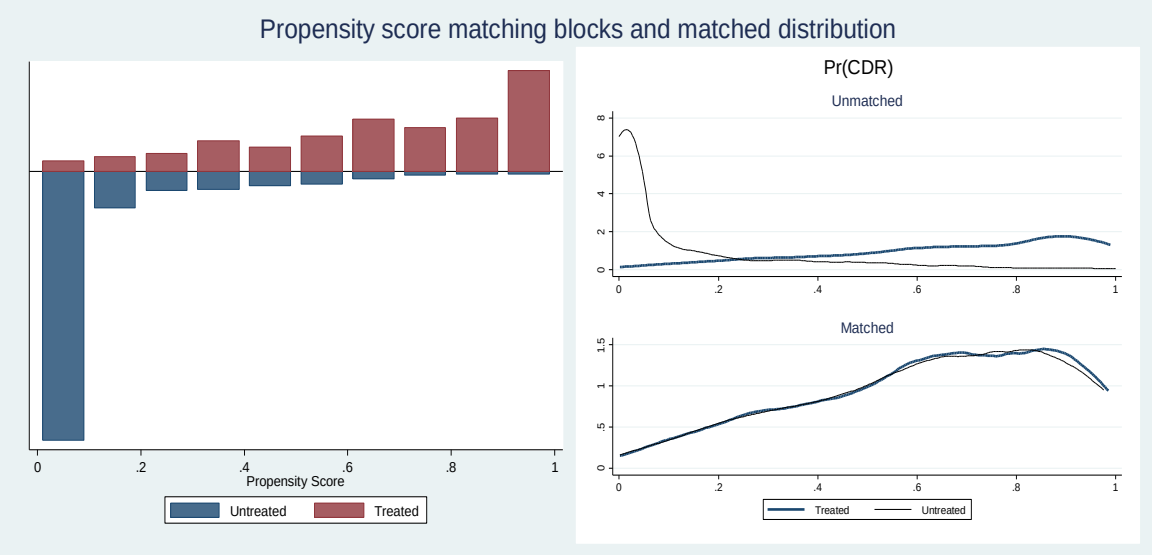
Table 3.A3

Propensity to participate in CDR–Logit model and descriptive statistics

Panel A: Logit model			Panel B: Descriptive statistics of matched sample			
Dependent variable: CDR	**Coefficient**	**S.E.**	**Member banks**	**Non-member banks**	**p-value**	**t-stats**
Log of Age	0.887***	[0.343]	4.23	4.16	0.28	1.08
Log of number of employee	-2.434***	[0.713]	9.18	9.28	0.50	-0.67
Log of number of branches	1.272**	[0.519]	6.54	6.65	0.42	-0.80
Listed bank dummy	1.879*	[0.963]	0.89	0.92	0.35	-0.94
Bank size (log total assets)	2.265***	[0.368]	12.10	12.15	0.65	-0.46
Observation	1,340					

Note: In Panel A, the dependent variable CDR is an indicator variable that takes value 1 for banks which participated in Corporate Debt Restructuring Mechanism in 2003 and thereafter or else zero. We use the logarithm of total age of individual banks, the number of employees, branches, listed dummy and banks size of each bank in the Logit model in order to measure the propensity score where standard errors are clustered at the bank level and reported in brackets. Since information on bank employees are missing prior to 1997, our total number of observations is reduced to 1340. The Hosmer–Lemeshow test (p-value = 0.62) confirms the goodness-of fit of the Logit model. In Panel B, we show the descriptive statistics of the matched sample for which p-values are reported.

Figure A3.2
Propensity score matching blocks and matched distribution



Graph on the left shows several blocks where member and non-member banks were matched. Graphs on the right show the Kernel distribution of the matched and unmatched banks.

Chapter IV

Is financial inclusion good for bank stability? International evidence

Abstract

We offer the first empirical evidence on the complementary effect of inclusive financial sectors on soundness of individual banks. Using a unique financial access survey database, we construct a composite index of financial inclusion for 87 countries for the period 2004-2012, and then investigate a new research question as to whether the global policy drive towards greater financial inclusion is good for bank stability in a sample of 2,913 banks. We find that a higher level of financial inclusion leads to greater bank stability. This complementary effect is more pronounced when banks have higher market power and operate in countries where the political stability, rule of law, regulatory quality as well as the overall institutional quality are greater. Exploiting the cross-country, cross-year variation in the timing of pro-access policies of countries that are members of a global network of policymakers, we further corroborate our claims and uncover new causal evidence to show that enabling an inclusive financial environment indeed increases bank soundness by almost 36% in the treated countries. Our results highlight that the importance of ensuring an inclusive financial system is not only a development goal but also an issue that should be prioritised by the financial institutions as such a policy drive is good for banks in terms of their stability. Our results remain insensitive to an array of robustness tests.

"*What improves the circumstances of the greater part can never be regarded as inconveniency to the whole. No society can surely be flourishing and happy, of which by far the greater part of the numbers are poor and miserable*".

Adam Smith (1776)

4.1 Introduction

While the recent empirical literature provides evidence on the positive role of financial inclusion in promoting wellbeing of households and economic growth through extending the access of the disadvantaged groups to basic financial services in the form of greater use of formal bank account and savings, little attention has been devoted to investigating whether such a development goal has ramifications on the soundness of banks.[50,51] The most challenging issues for the financial institutions to facilitate access to finance are the high operating costs and the risk associated with servicing, monitoring and administering loans to individual households and small and medium enterprises (SMEs) who often lack required documentations, collateral and credit histories (e.g., Conning, 1999; Demirgüç-Kunt, Beck and Honohan, 2008, henchforth DBH; Hermes, Lensink and Meesters, 2011). Broadening the access of the low income groups to formal financial services has therefore always been perceived as an antagonistic strategy that might dampen the performance of banks.[52] Using a large sample of bank-level data on 2913 banks across 87 countries over the period 2004 to 2012, this paper focuses on a specific dimension of financial development – financial sector inclusiveness – and an important regulatory issue at the micro level – bank stability; it supports the opposing view that inclusive financial

[50] See, for example: Wurgler (2000); Beck, Levine and Loayza (2000); Klapper, Laeven and Rajan (2006); Demirgüç-Kunt, Beck and Honohan (2008); Burgess and Pande (2005), and Banerjee, Duflo, Glennerster and Kinnan (2013), in India; Bruhn and Love (2009), and Bruhn and Love (2014), in Mexico; Karlan and Zinman (2010), in South Africa; Dupas and Robinson (2009), in Kenya.

[51] The degree of financial intermediation causally impacts economic growth and employment (see a survey in Pasalı, 2013).

[52] A recent study suggests that almost 2.5 billion adults, just over half of the world's adult population, do not use any form of formal financial services, where 19% and 72% of them are from developed and developing countries, respectively (Kendall, Mylenko and Ponce, 2010).

sectors and bank performance are, indeed, complementary.[53]

In recent years, formal financial institutions have been increasingly searching for new opportunities and markets and seeing the benefits of a micro-finance style of operations.[54] Since formal financial institutions have superior scale, skill and technological capacity (Peachy and Roe, 2006; DBH, 2008; Beck, Demirgüç-Kunt and Martínez Pería, 2011), many of them have extended their networks towards poor households and SMEs for higher profitability (Hermes, Lensink and Meesters, 2011). By exploiting technological advancements they can provide basic financial services to a large number of customers, especially those on the lower rung of the income ladder potentially at a reduced cost. With a supportive regulatory environment, by exploiting scale economies banks can not only ease financial constraints to marginalised groups and small firms, but also reduce risk and be more profitable at the same time (see e.g., De la Torre, Martínez Pería and Schmukler, 2010; Montgomery and Weiss, 2011).

Furthermore, over the past few decades, the central banks both in emerging and developed countries have taken many initiatives in conjunction with multilateral agencies including the IMF, G20, the Alliance for Financial Inclusion (AFI), and the Consultative Group to Assist the Poor (CGAP) to enhance the inclusive banking agenda (see DBH, 2008). Furthermore, in the last two decades, the banking sectors in the developing countries experienced increasing presence from foreign-owned banks, which are more sophisticated and equipped to attract larger firms and high-net-worth individuals, leading domestically owned banks to search for new markets that were previously underserved and/or excluded (See DBH, 2008, p.78). A more recent study by Beck and Brown (2014) use survey data for over 16,500 households from 19 emerging economies and confirm this

[53] Throughout this paper, we use the term “bank performances” and “bank stability” interchangeably.
[54] See a detailed survey in Harper and Arora (2005) on why commercial banks are so interested in micro-finance style of operations.

notion that foreign banks “cherry pick” financially transparent customers. At the same time, over the past decade, many countries have undertaken a large number of banking regulatory reforms (Barth, Caprio and Levine, 2008), which perhaps have had a meaningful effect on levels of financial inclusion and hence to the soundness of financial institutions. Given the changed regulatory environment, it therefore would be interesting to investigate how financial inclusion impacts banking stability.

To our knowledge, there is no direct empirical evidence on the channels through which financial inclusion affects bank stability. Existing literature implicitly indicates several potential channels through which financial inclusion may have significant influence on the soundness of banks or risk-taking (see section 4.2). The modern portfolio theory suggests that diversification (geographic/sectoral) enables banks to reduce earnings volatility and adverse risk-taking incentives through cross-subsidization (Boot and Schmeits, 2000). It also allows banks to reduce distance to a large number of customers. By reducing distance to customers, banks can improve efficacy of services while dealing with informationally opaque ones (e.g., Degryse and Ongena, 2005; Hauswald and Marquez, 2006; Mian, 2006; Deng and Elyasiani, 2008). Hauswald and Marquez (2006) develop a model and show that a bank can get a precise signal about a borrower’s quality if it decreases distance from the borrower. Therefore, geographical outreach associated with financial inclusion should facilitate lender-borrower proximity, reducing the adverse selection problem and cost of monitoring, which in turn should improve banking stability.

Recent evidence suggests that retail deposits are sluggish, insensitive to risks and provide a stable cheaper source of long term funding (see Song and Thakor, 2007), compared to wholesale funding which is extremely volatile and often costly (Huang and Ratnovski, 2011). Empirical studies also support this notion that banks relying more on retail deposits rather than on wholesale financiers were more stable during the recent financial crisis (e.g., Demirgüç-Kunt and Huizinga, 2010; Poghosyan and Čihak, 2011).

While banks extend deposit facilities to a large pool of customers, they are able to attract a large number of small retail deposits which are often cheaper than wholesale funding. Therefore, greater diversification in funding strategy associated with financial inclusion in mobilising deposits should reduce risks and funding costs of banks, enhancing bank stability.[55] Again, recent evidence, with respect to Chilean banks, suggests that tail risks on large loans are greater compared to small loans (Adasme, Majnoni and Uribe, 2006).[56] In addition, disbursing small loans is always a routine and standard task, which involves less monitoring and screening cost. While banks extend credit to customers, they are able to obtain proprietary information about borrowers (e.g., Black, 1975; Fama, 1985; Rajan, 1992), which is indispensable in reducing asymmetric information (cf. Nakamura, 1994). Therefore, by extending the access of a large pool of customers to small credits, banks can decrease potential monitoring costs and losses compared to large loans, enhancing the soundness of banks. Therefore, financial inclusion is the key ingredient to financial development strategies that can have a substantial impact on inclusive economic growth enhancing social stability and equity, and should be correlated with efficient financial intermediation and stability (Hawkins, 2006; Khan, 2011; Cull, Demirgüç-Kunt and Lyman, 2012).

Despite the remarkable benefits of access to finance on financial development and hence to inclusive economic growth, there is no empirical literature on the issues related to bank stability. Perhaps the most closely related paper is the seminal work by Beck, Demirgüç-Kunt and Martínez Pería (2007), henchforth BDM) who investigate the

[55] Several governments, especially in the developing countries, are making financial inclusion an essential part of their national plans. For example, on 28 August 2014, the government of India launched the '*Pradhan Mantri Jan Dhan Yojana*' (Prime Minister's People Money Scheme), with the explicit aim of removing financial exclusion. Though this scheme has an option for opening new bank accounts with zero balance, banks were able to garner deposits of INR1500 crore (US$240 million) within two weeks of the launch of the scheme, with around 30.2 million new accounts.

[56] Using randomized experiments, De Mel, McKenzie and Woodruff (2008) in Sri Lanka and McKenzie and Woodruff (2008) in Mexico, estimate capital returns to investment in microenterprises, and find that micro-entrepreneurs are indeed able to pay the high interest rates charged by microfinance institutions.

determinants of financial sector outreach, and its role on a firm's financing obstacles. They find that firms report less severe financing obstacles in countries with better outreach. More recently Beck, Lin and Ma (2014) investigate the link between bank branch outreach and a firm's tax avoidance. The limited research in this area is somewhat obvious given the limitations of supply- and demand-side data availability on access. In addition, the lack of development of a reliable quantitative index of financial inclusion hitherto restricts explicitly analysing the effects of inclusive financial systems on various aspects of banking performances.

This study fills a gap and makes several contributions to the literature. First, while most of the empirical papers assess the effect of financial inclusion on various socio-economic indicators (e.g., Butler and Cornaggia, 2011; Allen, Carletti, Cull, Qian, Senbet and Valenzuela, 2013; Demirgüç-Kunt, Klapper and Randall, 2013; Demirgüç-Kunt, Klapper and Singer, 2013), or use a disaggregated single indicator of financial inclusion (e.g., BDM, 2007), this paper constructs a multidimensional index of financial inclusion at country level, to see the effect on bank-level stability in a cross-country analysis, including developed, developing and transition economies while controlling for bank-specific, country-specific and institutional characteristics that one typically encounters in financial development literature. Our financial inclusion index has some advantages over the measures used in literature. Specifically, we use an IMF *Financial Access Survey* (FAS) dataset to construct a composite index of financial inclusion incorporating three different dimensions, accessibility, availability and usage, which are deemed to have a substantial impact on inclusiveness in the financial sector (see sub-section 4.3). As these dimensions are highly correlated with each other, we capture common variation among them using principal component analysis (PCA). Then, we develop an index of financial inclusion deriving the weight of each dimension, which is useful because it allows us to construct a composite index that enables comparison across countries— minimising concerns about

measurement error. The time series dimension of this index allows us to exploit within country variation in the inclusiveness of the financial sector, and explore the effect on bank stability in a systematic way. We also test the validity and robustness of our index using data from the World Bank global financial inclusion index (henceforth Global Findex) and World Bank Enterprise Surveys (WBES).

Second, addressing the impact of financial inclusion on bank stability is non-existent both in academic and regulatory circles.[57] This paper is the first, to our knowledge, to address this research agenda in a cross-country setting to contribute to the contemporary policy issue related to financial development and financial inclusion using bank level data of 2913 banks across 87 countries for the period 2004-2012. Most of the evidence is either anecdotal[58] and/or uses simple analyses at the macro-level (e.g., Hannig and Jansen, 2010; Han and Melecky, 2013; Morgan and Pontines, 2014). Third, we use instrumental variable (IV) estimator to extract the exogenous component of financial inclusion while controlling for unobserved bank characteristics that might affect both financial inclusion and stability, reducing concerns about endogeneity. Fourth, our paper contributes to the literature that explores the determinants of banking stability (e.g., Berger, Klapper and Turk-Ariss, 2009; Laeven and Levine, 2009; Houston, Lin, Lin and Ma, 2010; Beck, De Jonghe and Schepens, 2013; Anginer, Demirgüç-Kunt and Zhu, 2014). Fifth, our study offers in-depth evidence of the impact of financial inclusion on banking stability for a large number of developed and developing countries over a period that comprises the recent global financial crisis. During this period, regulators of most of the financial systems emphasise broadening the access of the marginalised groups to formal financial services while also

[57] Throughout this paper, we use the term "access-stability" and "financial inclusion-bank stability" interchangeably.

[58] Tetangco, A., "Philippines CBG: the positive influence of financial inclusion", the Banker, October 1st 2013, http://www.thebanker.com/Comment/Viewpoint/Philippines-CBG-the-positive-influence-of-financial-inclusion?ct=true

keeping balance between the soundness of banks, especially in the post crisis era. Therefore, understanding the link between these two variables is important and should be useful to researchers and policymakers for articulating policies that are mutually reinforcing in order for ushering inclusive economic growth. Sixth, the cross-country nature of our dataset allows us to explore the role of bank competition and the institutional environment on the access-stability relationship, which are of particular interest for policy. Finally, we run an array of sensitivity checks using other proxies of financial inclusion, bank competition and stability, by executing alternative estimation approaches (panel data vs. cross section) and by employing different sample specifications, particularly running regression for the sample of developing countries. We also exploit the variation in the membership timing of countries of a network of financial inclusion policymakers and explore the causal effects of financial access policies on banking stability using a "Quasi-natural experiment" approach. To alleviate any selection bias and confounding factors in the treatment effects, we employ both parametric, difference-in-differences as well as non-parametric, matching estimators.

Our results indicate that there is a strong link between financial inclusion and bank stability. In particular, the higher the degree of financial inclusion, the better the bank performance is, in terms of reducing risks. The evidence also suggests that any beneficial effects of financial inclusion on bank stability tend to be more pronounced in banking sectors with less competition. As banks expand their operations towards areas that were previously underserved and/or excluded, they are able to reduce excessive risk taking when they have higher market power. We also investigate the influence of institutional settings on the access-stability relationship, and find that the institutional environment in which banks operate reinforces the complementarity effects of financial inclusion on the soundness of banks. Specifically, greater freedom of expression, political stability, regulatory quality, rule of law and less corruption enhances the positive relationship

between financial inclusion and bank stability.

Before proceeding, we would like to add an important caveat to our results. We derive our financial inclusion measure from the IMF's FAS dataset by using supply side data at the macro level. Though we tried to add as many dimensions as possible to get a comprehensive picture of overall financial inclusion of a country, we acknowledge that there must be other factors contributing to financial inclusion. However, we have checked the robustness of our results running the same regressions using different measures of financial inclusion, and found unambiguously similar results.

The remaining part of the paper is organised as follows: Section 4.2 reviews the literature on financial inclusion and its potential relationship with bank stability. Section 4.3 outlines the empirical models and Section 4.4 describes the data and descriptive statistics. Section 4.5 discusses the empirical results with sensitivity analyses, while Section 4.6 concludes with some policy implications.

4.2 Related Literature and Hypothesis Development

We hypothesise that broadening access of all economic agents to formal financial services – greater financial inclusion – is likely to have an important influence on the degree of bank stability. From a theoretical perspective, it is a priori not clear whether an inclusive financial sector is good for bank stability (i.e., less risk taking). Through financial outreach–geographical and demographical bank branch network penetration– banks can serve a wide range of customers potentially at a reduced cost once necessary infrastructures are in place (see Berger, Hasan and Zhou, 2010). By exploiting expertise i.e., managerial and technical expertise, they can improve operating efficiency and revenues as they have cheaper funding, new lending and investment opportunities (see e.g., Saunders, 1994; Berger and DeYoung, 2001; Deng and Elyasiani, 2008; Demirgüç-Kunt and Huizinga, 2010).

It is argued in the literature that retail deposits are sluggish, insensitive to risk and provide a stable cheaper source of long term funding (e.g., see Calomiris and Kahn, 1991; Song and Thakor, 2007), compared to wholesale funding which is extremely volatile and often costly (e.g., see Demirgüç-Kunt and Huizinga, 2010; Huang and Ratnovski, 2011; Poghosyan and Čihak, 2011).[59] Huang and Ratnovski (2011) show that wholesale financiers are prone to very mild negative information or rumours, and most of the time they are reluctant to rollover short-term funding as they have access to information on the quality of bank projects. While comparing informed and arm's length debt, Rajan (1992) finds that the informed debt holders (i.e., wholesale funders) could discontinue funds for a project with negative present value unless they are compensated with higher interest rate. Recent empirical studies also show that banks relying more on retail deposits rather than on wholesale funding were more stable during the recent financial crisis (e.g., Demirgüç-Kunt and Huizinga, 2010; Poghosyan and Čihak, 2011). Demirgüç-Kunt and Huizinga (2010), using a sample of listed banks in 101 countries for the period 1995-2007, also find that a higher level of non-deposit funding shares increases banking fragility. Ratnovski and Huang (2009) show that the ample retail depository funding was the key factor behind the relative resilience of Canadian banks during the 2008 turmoil. Moreover, during the recent credit crunch when the wholesale funding dried up it was the diversified retail deposit base that cushioned financial institutions from fragility (see Hannig and Jansen, 2010). While banks extend deposit facilities to a large pool of customers they are able to attract a large number of small retail deposits which are often cheaper than wholesale funding.[60]

[59] The retail deposits are sluggish because the withdrawals of them are motivated by the individual depositors' liquidity need, and thus it is predictable based on the law of large numbers. In addition, they are insensitive to risk partly because of the deposit insurance provided by the government (e.g., Kim, Kliger and Vale, 2003; Song and Thakor, 2007). For example, in all recent bank failures (e.g., Continental Illinois, Northern Rock, IndyMac), it was short-term wholesale financiers who exited faster than retail depositors without having significant losses. In the case of Northern Rock, retail depositors' run on the bank took place after it had nearly exhausted its liquid assets to pay short-term wholesale financiers (Shin, 2009; Goldsmith-Pinkham and Yorulmazer, 2010).

[60] Several governments, especially in the developing countries, are making financial inclusion an essential

Therefore, greater diversification in funding strategy associated with financial inclusion in mobilising deposits should reduce the risks and funding costs for banks, enhancing bank stability; for example, during financial distress when panic gets into depositors, they run on banks to withdraw their savings (Diamond and Dybvig, 1983; Shin, 2009). Recently, Han and Melecky (2013) found international evidence for the period 2006-2010 that, by dint of the law of large numbers, correlated deposit withdrawals (i.e., bank runs) could be mitigated during stressful times if bank deposits are more diversified i.e., held by more individuals and firms.

The greater financial inclusion is also likely to influence the overall level of lending opportunity for banks. By reaching out to unbanked/underbanked areas while extending small credits, banks can reduce distance and build strong relationships with customers. Recent literature shows that a large distance between lender and borrower undermines the efficacy of banking services through intensification of the asymmetric information problem (Degryse and Ongena, 2005; Hauswald and Marquez, 2006; Mian, 2006; Deng and Elyasiani, 2008). Hauswald and Marquez (2006) develop a model and show that lenders can get precise signals about a borrower's quality if they decrease the distance from the borrower. In addition, banks can also reduce informational asymmetry by obtaining proprietary information about borrowers while providing access to basic financial services (e.g., Black, 1975; Fama, 1985; Rajan, 1992). To deal with less creditworthy clients and those who often lack collateral, banks need to adopt lending techniques that are based on soft information (i.e., relationship lending). Exploiting this lending technology, they can also reduce moral hazards and adverse selection problems,

part of their national plans. For example, on 28 August 2014, the government of India launched the '*Pradhan Mantri Jan Dhan Yojana*' (Prime Minister's People Money Scheme), with the explicit aim of removing financial exclusion. Though this scheme has an option for opening new bank accounts with zero balance, banks were able to garner deposits of ₹1500 crore (US$240 million) within two weeks of the launch of the scheme, with around 30.2 million new accounts.

and get comparative advantage over other financial institutions seeking informational rents (see Sharpe, 1990; Petersen and Rajan, 1994; Buch, Koch and Koetter, 2012).[61] For example, using US bank holding companies, Akhigbe and Whyte (2003) and Deng and Elyasiani (2008) find that geographic diversification enhances bank value and risk reduction. Deng and Elyasiani (2008) also find that diversification across more remote areas (in our case, the areas where financial services are hardly available) is associated with greater value enhancement and a slighter risk-reduction effect. Therefore, when banks diversify to regions where a greater unbanked population is located, they are better able to understand the nuances of the local household/firm environment, which should reduce the probability of default rates, cost of monitoring and enhance lender-borrower proximity, and relationship, which in turn enhances risk-reduction.[62]

In contrast, if banks attract a large pool of extremely low creditworthy borrowers due to financial inclusion, it can derail banking stability as they need to extend small credits to a wider set of borrowers.[63] In a recent study, Adasme, Majnoni and Uribe (2006) with respect to the portfolio of Chilean banks, show that losses on large loans are greater and more unpredictable than losses on small ones.[64] It suggests that by providing access to credit to a large number of small borrowers, banks should be able to reduce monitoring costs and volatility of earnings. In addition, disbursing small loans is always a routine and

[61] Linking three unique data sets, in a more recent study, Beck, Degryse, De Haas and Van Horen (2014) show that relationship lending alleviates SMEs' credit constraints during a cyclical downturn, and this effect is strongest for smaller and more opaque firms, and in regions where the downturn is more severe.

[62] It may also be the case that geographic diversification is associated with banking stability loss due to informational asymmetries binding with poor households or small firms. It may also occur due to lack of managerial and technical expertise, agency problems related to complex organisational and product structure (Acharya, Hasan and Saunders, 2006). Investigating the impact of geographic diversification, Acharya, Hasan and Saunders (2006) on Italy and Goetz, Laeven and Levine (2013) on the U.S., did not find any improvement in the risk-return trade-off and market valuations, respectively.

[63] Regarding the recent subprime crisis, Rajan (2011) elucidates that "easy credit" as a mechanism to reduce income inequality can create a "fault line" along the financial system undermining the financial stability owing to enormous stresses.

[64] Using randomized experiments, De Mel, McKenzie and Woodruff (2008) in Sri Lanka and McKenzie and Woodruff (2008) in Mexico, estimate capital returns to investment in microenterprises, and find that micro-entrepreneurs are indeed able to pay the high interest rates charged by microfinance institutions.

standard task, which involves less monitoring and screening cost. Moreover, according to portfolio theory, diversified banks can decrease earning volatility and adverse risk-taking incentives through cross-subsidisation (Boot and Schmeits, 2000). Rossi, Schwaiger and Winkler (2009) with Austrian banking data find that increased diversification of loan portfolio requires banks to keep lower future provisioning, which in turn results in a reduction of realised risk. Using conventional and Islamic banks for the period 2002-2010, Shaban, Duygun, Anwar and Akbar (2014) find that profitability is one of the main reasons for Indonesian banks to lend to small businesses. They also find that greater diversification of loans towards small businesses is associated with lower risk provisions for Indonesian banks. Therefore, by extending the access of a large pool of customers to small credit, banks can decrease potential monitoring costs and losses compared to large loans, which in turn improves the soundness of banks.

Above all, since greater financial inclusion increases the supply of bank credit, which is always the vital and cheaper source of external finance for SMEs (e.g., Petersen and Rajan, 1997; Berger and Udell, 1998), it also aids in the growth of small firms, and firms that need external finance. Literature evokes that financial development (i.e., financial inclusion) disproportionately helps industries with a technologically larger share of small firms, and also the industries with higher dependence on external finance (Rajan and Zingales, 1998; Beck, Demirguc-Kunt, Laeven and Levine, 2008). Since more inclusive financial systems will ameliorate market frictions–i.e., informational opacity and transaction costs–small firms and firms that rely more on external finance in the economy will grow faster because of relatively easier access to credit. With the increasing supply of credit, borrowers will get favourable loan contracts, which is vital to disincentivise borrowers from asset substitution–where borrowers utilise the funds to invest in riskier projects, which in turn enhances bank stability as the borrower's default probability

decreases.

Apart from the channels discussed above, there are some exogenous risks (i.e., natural disasters, social and political disruptions) that can undermine efficient financial intermediation and stability (Hawkins, 2006). Therefore, our final channel is social and political stability. A number of recent studies find that greater financial inclusion reduces income inequality and poverty (e.g., Burgess and Pande, 2005; Beck, Demirgüç-Kunt and Levine, 2007; Bruhn and Love, 2014); increases employment (e.g., Prasad, 2010); improves mental well-being (e.g., Karlan and Zinman, 2010; Angelucci, Karlan and Zinman, 2013); favours education (e.g., Flug, Spilimbergo and Wachtenheim, 1998); helps with better decision-making (e.g., Mani, Mullainathan, Shafir and Zhao, 2013); and enhances new firm creation (e.g., Guiso, Sapienza and Zingales, 2004; Klapper, Laeven and Rajan, 2006; Banerjee, Duflo, Glennerster and Kinnan, 2013).[65] For example, using state-level data in India, Burgess and Pande (2005) find that expanding bank branches in rural areas had a significant positive impact on poverty alleviation.[66] Similarly, recently, Bruhn and Love (2014) provide evidence from Mexico using randomized evaluation suggesting that facilitating better access to finance to the poorest of the poor has a positive impact on poverty alleviation. They also find that access to financial services has a positive impact on economic development through the channel of keeping individuals employed and fostering the survival and creation of informal business. As the nature of SMEs business operations is labour intensive, Prasad (2010) observes that financial constraint to SMEs has adverse effects on employment growth. On a study of Compartamos borrowers

[65] Bauchet, Marshall, Starita, Thomas and Yalouris (2011) summarize evidence from randomized evaluations of microfinance. The general findings of these studies are that financial services have a positive impact on numerous microeconomic indicators, including self-employment, business activities, household consumption, and well-being.

[66] Jayaratne and Strahan (1996), using branching deregulation implemented by different U.S. states between the mid-1970s and mid-1990s, find that the relaxation of intra- and interstate branching had a positive impact on economic growth.

in Mexico, Angelucci, Karlan and Zinman (2013) find that access to credit does have a positive impact on mental well-being. Therefore, the positive effect of financial inclusion on various key socio-economic indicators is indispensable to inclusive economic growth and sociopolitical stability, which in turn could lead to greater efficiency in the financial intermediations and soundness of banks (see e.g., Hannig and Jansen, 2010; Khan, 2011; Cull, Demirgüç-Kunt and Lyman, 2012).

Overall, since providing access to finance seems to have multiple positive effects on many aspects of the economy including banking operations, we therefore view the link between financial inclusion and bank stability as ultimately an empirical question.

Hypothesis 1: financial inclusion is positively associated with bank-level stability.

4.3 Methodology

We examine the impact of financial inclusion on banking stability using bank-level data from 87 countries. It is possible that the results of the study may be biased because of the endogeneity problem between financial inclusion and bank stability. Endogeneity can arise if a bank engages in risky activities in the current set-up and ventures into rural areas to offset high risk and/or if they self-select into inclusive financial activities because these reward them with greater market power and profitability. Therefore, we use an instrumental variable technique with a two-step generalized method of moments (GMM) estimator using the heteroskedasticity and autocorrelation consistent (HAC) variance estimation of Newey and West (1987).[67] This estimator extracts the exogenous component of financial inclusion, reducing concerns about endogeneity. We run several regressions using the following baseline model:

[67] Since GMM accounts for heteroskedasticity and autocorrelation it is more efficient than 2SLS (Hall, 2005).

$$
\begin{aligned}
Bank\ Stability_{ijt} = {} & \beta_0 + \beta_1 Loan\ Ratio_{ijt} + \beta_2 Bank\ Size_{ijt} + \beta_3 Loan\ Loss\ \Pr ovision_{ijt} \\
& + \beta_4 Income\ Diversification_{ijt} + \beta_5 Management\ Quality_{ijt} \\
& + \beta_6 Bank\ Equity_{ijt} + \beta_7 Bank\ Competition_{ijt} + \beta_8 Financial\ Inclusion_{jt} \\
& + \beta_9 GDP\ Growth_{jt} + \beta_{10} Per\ Capita\ GDP_{jt} + \alpha_i + Year_t + \varepsilon_{ijt}
\end{aligned} \tag{3.1}
$$

where the *i, j* and *t* subscripts indicate bank, country and year, respectively. *Bank stability* is ln(Z-score), measured at the bank level. We control for various bank-specific and country-specific characteristics, and the detailed definitions of them are presented in Table 4.1. Our main explanatory variable of interest is the financial inclusion index, measured at the country level. To control for time invariant bank heterogeneity and time varying global business cycle effects, we include bank fixed effects α_i and year fixed effects $Year_t$, respectively. As a robustness test, we use standard deviation of return-on-assets (ROA). Since expanding the access of the low yield clienteles to basic financial services may have a negative impact on the bottom line of banks, it is natural to check the robustness of our results using income volatility of individual banks as an alternative measure of banking stability. Furthermore, considering the recent development on the measures of bank competition, we employ both conventional and efficiency adjusted Lerner indices as measures of *Bank Competition*, which should also provide robustness to our results.[68]

4.4 Data and descriptive statistics

To investigate the relationship between financial inclusion and bank stability, we draw data from a number of sources: (1) the bank level dataset compiled from the BankScope database provided by Bureau van Dijk and Fitch Ratings, that contains detailed balance sheet and income statement information for both public and private banks in any

[68] We use lagged values of Lerner indices to mitigate any remaining endogeneity issues that may be associated with market power and stability (see e.g., Turk Ariss, 2010; Love and Martínez Pería, 2014).

given country; (2) the macro data compiled from the World Bank World Development Indicators (WDI); (3) the instruments for IV regressions collected form the Heritage Foundation, Doing Business database, and Entrepreneurship database; (4) the variables used to construct financial inclusion index compiled from the IMF's FAS database; and (5) six indicators of institutional quality taken from the Kaufmann, Kraay and Mastruzzi (2010) Governance Index. Our dataset comprises 2,913 commercial banks, cooperative banks and Islamic banks (13,836 bank-year observations) in 87 countries over the time period 2004-2012, which represent, respectively 57.4%, 41.3%, and 1.3% of the sample. Since the objective of this study is to investigate the impact of financial inclusion on bank stability, we apply a number of selection criteria to obtain our sample. First, we exclude countries for which we have no information on different dimensions of the financial inclusion index. Second, we discard unconsolidated reports of banks whenever consolidated ones of the same group are available to offset double counting. Third, we drop banks that had information for fewer than three consecutive years, as the bank stability measures computed in this study are based on rolling windows over the past three years. We deflate all monetary values to 2005 (2005 = 100) prices using the GDP deflator of the U.S. obtained from the WDI. The deflated series are reported in millions of U.S. dollars ($).

4.4.1 Measuring bank risk

We follow Laeven and Levine (2009) to measure the *Z-score* which is widely used in the literature and considered to be an unbiased and complete indicator of bank riskiness (see, for instance, Houston, Lin, Lin and Ma, 2010; Turk Ariss, 2010; Fang, Hasan and Marton, 2014). Using assets returns, their volatility and leverage, we calculate the *Z-score* as follows:

$$Z - score_{it} = \frac{ROA_{it} + EQA_{it}}{\sigma(ROA)_{it}} \quad (3.2)$$

where ROA and EQA are the average return-on-assets and the equity-to-assets ratio, respectively and $\sigma(ROA)$ is the standard deviation of return-on-assets. We can interpret this score as the number of standard deviations below the mean by which returns would have to drop before all equity in the bank gets depleted (Boyd and Runkle, 1993; Beck, De Jonghe and Schepens, 2013). If bank profitability is normally distributed, the inverse proxy of the *Z-score* can be considered as the bank's probability of insolvency. In other words, higher returns and capitalisation would increase but volatile returns would decrease the stability of banks.

4.4.2 Measuring financial inclusion index

4.4.2.1 Financial inclusion index

In an inclusive financial sector, any member of the economy, irrespective of background, should enjoy the ease of access, availability, affordability and usage of the basic financial services provided. Therefore, while measuring an index of financial inclusion one should incorporate as many dimensions as possible that may have an impact on inclusiveness of the financial sector. Information on various dimensions may be obtained from demand-side surveys, such as the World Bank's Global Financial Inclusion (Global Findex) database, an individual-level database comprised of survey data collected over the 2011 calendar year covering more than 150,000 adults in 148 economies. Since the costs and collection of survey data are demanding, and the availability of such data for a longer period is unreasonable, we therefore focus on supply-side data that were collected by BDM (2007) with the joint effort of the World Bank for 2003-2004, and later on extended by the Consultative Group to Assist the Poor (CGAP) and by the International Monetary Fund (IMF).

In this study, we use the *IMF Financial Access Survey (FAS)* dataset to measure the index of Financial Inclusion for 87 countries for the period 2004-2012. Unlike Global Findex, the time-series dimension of this index allows us not only to explore the relationship between financial inclusion and bank stability over time but also to exploit the within-country variation in financial inclusion of any given banking system. In general, there is a consensus, at least from the regulator's perspective, that financial inclusion can be measured using four dimensions, namely the penetration/accessibility, availability, affordability and usage. Given the data availability constraint, the variable we use for each dimension often requires proxies. For the penetration dimension, we use the number of bank accounts per 1,000 people in order to integrate the depth of the financial access.[69] The availability dimension is used to account for the pervasiveness of the outreach of the financial sector in terms of banks' physical outlets, as physical distance to physical point of financial services is considered an important impediment to financial inclusion (see Allen, Carletti, Cull, Senbet and Valenzuela, 2014). We use two classes of penetration of banking services i.e., demographic and geographic penetration of bank branch and ATM (see BDM, 2007). For the demographic penetration, we use the number of bank branches and number of ATMs per 100,000 people, and for the geographic penetration we use the number of bank branches and number of ATMs per 1,000 square kilometres.[70] The affordability dimension can also be classified into various sub-categories that include "transaction costs" and "ease of transaction".[71] Since the data on the affordability

[69] The actual representation of penetration dimension would have been the number of people having banking accounts rather than the number of accounts per capita. The caveat is that in the latter case the "banked" population might be overestimated due to dormant accounts and/or double count of accounts of the same person.

[70] As the distribution of bank branches and ATMs is not always uniform and often concentrated in urban areas of the country and provides access to only some individuals, using area- and population-based ratios may undermine the true penetration of banking services (BDM, 2007).

[71] Having information on affordability dimension would certainly improve the quality of financial inclusion index, but comparable macro data for a large number of countries is hard to get. For example, the annual fees charged to customers for ATM cards and/or accounts i.e. "transaction costs" and the minimum amount and/or document requires opening savings or checking accounts i.e. "ease of transaction".

dimension is rather scarce, this dimension is not considered in the computation of the financial inclusion index. For the usage dimension, we use the volume of credit plus deposit relative to the GDP (see Table 4.1 for details).

BDM (2007) investigate financial sector outreach and its determinants by using cross-country data to identify common trends across the abovementioned indicators. It is easier for the general public to comprehend and compare an indicator across countries that is composite in nature, engrained with many correlated indicators (OECD, 2008). In this paper, we overcome the shortcomings, and build upon BDM (2007) to introduce a multidimensional weighted index of all variables as a measure of financial inclusion.[72]

The indicators used in the construction of financial inclusion are highly correlated with each other. To sufficiently capture the common variation among these correlated indicators of financial inclusion as a single measure, we develop an index that represents the overall inclusiveness in the financial sector using principal components analysis (PCA) (see Appendix 4.A for details on PCA). The first principal component from PCA has the interpretation of being the single linear combination of the financial inclusion indicators that explains most of the variations we see in these indicators. This index will sufficiently deal with the problem of multicollinearity and over-parameterization as a single measure of financial inclusion. Before using PCA, indicators of each dimension are normalised to have values of zero and one so that the scale in which they are measured is immaterial.[73] Since the availability dimension is comprised of four variables initially, we capture common variation among four outreach variables using the PCA and construct an availability dimension. Subsequently, we use the PCA to extract the common principal component (PC) of the three dimensions that capture different aspects of the inclusive

[72] Sarma and Pais (2011) measure a weighted index of financial inclusion using manual weights of the dimensions for a sample of 49 countries for the calendar year 2004.
[73] Prior to normalising, we winsorise each indicator at the 95th percentile levels to reduce the influence of outliers at the upper tail.

financial sector: the penetration, availability and usage of the financial services.

Table 4.A1 shows the results of the PCA. Regarding availability dimension, the eigenvalues of the four PCs are 2.81, 0.69, 0.45, and 0.05, respectively, suggesting that the first principal component explains about 70% of the corresponding sample variance (see Panel A).[74] Except for the first PC, no other PCs have an eigenvalue greater than one, so we just take the first component and extract the availability dimension using weights (i.e., 0.52, 0.52, 0.47, and 0.48) assigned to the first principal component. Regarding financial inclusion, the eigenvalues of the three PCs are 1.54, 0.99, and 0.45, respectively, indicating that the first principal component explains about 51% of the corresponding sample variance (see Panel B). Similarly, only the first principal component has an eigenvalue that is more than one so we can assume that the first component sufficiently explains the common variation among the three dimensions.[75] As shown in equation (4.3), we construct a multidimensional index for financial inclusion using the factor loadings (weights) of each dimension derived from the principal component analysis:

$$FII_{jt} = 0.71 * Penetration_{jt} + 0.71 * Availability_{jt} + 0.06 * Usage_{jt} \quad (3.3)$$

Equation (4.3) indicates that the financial inclusion index (FII) has somewhat higher weights on the penetration and availability dimensions, but relatively lower weights on the usage dimension.[76] In order to facilitate analysis and interpretation, we further normalise this index assigned to each country along a 0-1 scale, where zero indicates

[74] See Vyas and Kumaranayake (2006).
[75] Since we drop a few PCs, it also eliminates part of the noise components from our data, which ultimately may yield more reliable estimates.
[76] In order to check the stability and robustness of our financial inclusion index, we also use principal component analysis on a year-by-year basis in which loadings are determined annually instead of over the entire sample period. The correlation between these two indices (one where the loadings are derived over the entire sample period and the other derived annually) is very high (i.e. 0.98), indicating the robustness of our index irrespective of how loadings are determined.

financial exclusion, and unity indicates financial inclusion.[77]

4.4.2.2 Verifying the strength of the financial inclusion index

Although our paper makes the first systematic attempt to construct a composite index of financial inclusion for a longer panel and then analyse its impact on banking stability, it is not without its limitations. In the construction of the index, affordability dimension, marketing exclusion and self-exclusion have not been addressed. However, despite these shortcomings, we see this construction of composite index and the associated analysis as a useful and important first step towards developing a more robust indicator of financial inclusion. In this section, we borrow ideas from BDM (2007), and test the validity of the financial inclusion index. First, we use the Global Findex survey database, and check the correlation between household-based indicators of financial inclusion and the financial inclusion index. In some recent studies (e.g., Demirgüç-Kunt, Klapper and Singer, 2013; Allen, Carletti, Cull, Senbet and Valenzuela, 2014), the most common variables that are used as indicators of financial inclusion are *adults with an account at a formal financial institution to total adults (%) (i.e., Share of household account)* and *adults saving at a financial institution in the past year to total adults (%) (i.e., Share of household saving).* We find that our index is positively and significantly correlated at the 1% significance level with these Global Findex indicators. We also assess the power of our index to see whether our index is useful in predicting these observable micro-level data.

$$\begin{aligned} Share\ of\ household\ account &= 19.04\ (6.81) + 92.09\ (13.69) * Financial\ Inclusion \\ Share\ of\ household\ saving &= 6.59\ (3.94) + 92.09\ (7.65) * Financial\ Inclusion \end{aligned} \tag{3.4}$$

We collapse our data at the country level and regress the *share of household*

[77] The primary intention of constructing this index is to see the impact of financial inclusion on banking stability. Therefore, financial inclusion is measured across countries and period in order to take into account the evolution of the index.

account (the *share of household saving*) on *financial inclusion index* using robust standard errors. The regression yields R^2 of 57% (32%) with 81 observations. T-statistics are reported in the parentheses of equation (4.4). Financial inclusion index enters significantly at the 1% level, indicating that greater financial inclusion is positively associated with more households having accounts (savings) at financial institutions. The correlation between predicted share of household account (saving) and the actual share of household account (saving) at a financial institution is 76% (56%).

Second, so far we have seen that our index is powerful enough in predicting the household-based measure of financial access. Now, we use firm-level data taken from the World Bank Enterprise Surveys (WBES) in order to gauge the relationship between financial inclusion index and firms' access to finance, while controlling for firm-specific characteristics. WBES contains an expansive array of economic data on 130,000 firms in 135 countries over the period 2002-2014.[78] We run the following estimations at the firm-level:

$$F_{c,k,t} = \beta_0 + \beta_1 Financial\ Inclusion_{c,t} + \beta_2 X_{c,k,t} + \varepsilon_{c,k,t} \quad (3.5)$$

where F is the rating of financing obstacles reported by firm k in country c at time t and X is a set of control variables, which include firm size (employee), a dummy variable for manufacturing firms, a dummy for the firms that are involved in exporting, dummy variables for government and foreign-owned firms, age of the firms in years, GDP growth rate and regional dummies (see Table 4.1 and 4.2A for details). We run an ordered probit model to estimate equation (4.5), as financing obstacle is a polychotomous dependent variable with natural order where higher values indicate greater financing

[78] See Love and Martínez Pería (2014) for details on this database. In addition, out of 87, we could only match 64 countries' financial inclusion indices with the WBES database for the period 2004-2012.

constraints. It is expected that the greater the financial inclusion the less financing constraints there would be for firms to get access to credit. In addition, following Love and Martínez Pería (2014), we also use an alternative measure of access to finance. In this case, we construct an indicator variable that takes one if firm k in country c at time t has a bank loan, line of credit, or overdraft.[79] A positive relationship between financial inclusion index and access to finance is expected as a more inclusive financial system would alleviate financing constrains disbursing more credit to firms.

The results are reported in Table 4.A2. The findings confirm the expectation that firms tend to report lower (higher) financial constraints (access) in those countries where financial inclusion is greater. In particular, we find that financing obstacles are negatively related to an inclusive financial system, whereas access to finance is positively associated at the 1% significance level. Therefore, it once again assures the robustness of our index.

4.4.3 Measuring bank competition

Lerner index is used to measure the degree of bank competition. It is considered to be a more accurate measure of bank-specific competition than the so-called Panzar-Rosse H-statistics or the asset shares of the three largest banks (Carbó-Valverde, Rodriguez-Fernandez and Udell, 2009). The essence of pricing power is reflected through the Lerner index because it measures the disparity between price and marginal cost expressed as a percentage of price. In other words, it captures the degree to which a bank can increase their marginal price beyond their marginal cost. According to Berger, Klapper and Turk-Ariss (2009), the Lerner index is the only measure of market power calculated at the bank level as:

[79] Since there is some disparity between the Old (2002-2005) and the New core modules of the surveys, we follow BDM (2007) to construct Financing Obstacle, and Love and Martínez-Peria (2014) to construct Access to Finance.

$$Lerner_{it} = \frac{P_{it} - MC_{it}}{P_{it}} \tag{3.6}$$

where P_{it} is the price of total assets proxied by the ratio of total revenue (interest and non-interest income) to total assets for bank i at time t. MC_{it} is the marginal cost of producing an additional unit of output. The Lerner index is interpreted as the inverse of competition; the higher the index the greater the pricing power, which implies less competitive market conditions. Following conventional bank efficiency studies, in this paper we use stochastic frontier analysis (SFA) to estimate marginal cost and hence Lerner Index. The shortcoming of the conventional Lerner index (C-Lerner) estimated above is that it is measured assuming full bank efficiency and therefore it fails to account for the possibilities of bankers' inability to exploit output pricing opportunities resulting from market power. Therefore, we also follow Koetter, Kolari and Spierdijk (2012) to estimate efficiency adjusted Lerner index (E-Lerner) (as explained in Appendix 4.B). Table 4.B1 reports the descriptive statistics of the variables included in the cost and profit functions.

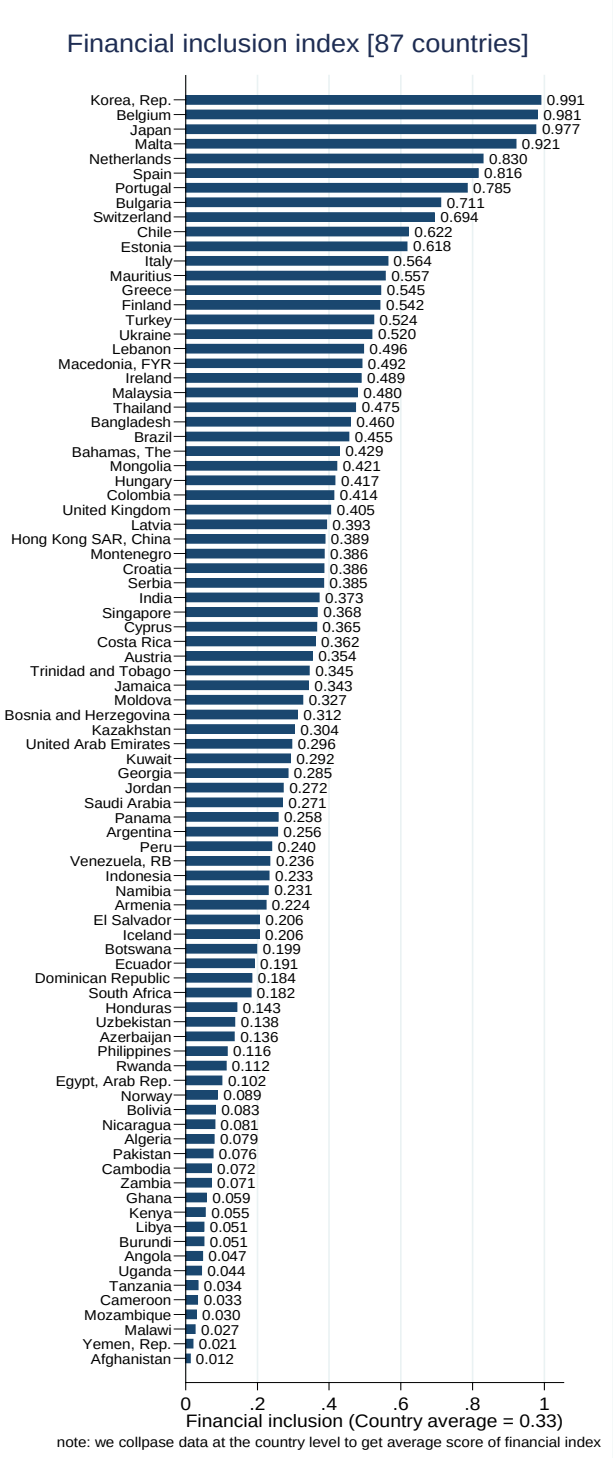
4.4.4 Bank-specific and macro control variables

We control for an array of standard bank-specific characteristics and macroeconomic variables. To account for liquidity risk of individual banks, we use ratio of total loans over total assets (Fang, Hasan and Marton, 2014). We use logarithm of total assets to account for potential size effect on banking stability and efficiency, as the too-big-to-fail attitude can destabilize the efficient financial intermediation of the entire banking system. The ratio of loan loss provision to total loans is used to account for an individual bank's loan portfolio risk. The ambiguous relation of income diversification on stability necessitates considering the effect of off-balance sheet activities of individual banks. The ratio of total earning assets to total assets is used as better management quality that can mitigate excessive risk-taking. Since, well-capitalised banks are assumed to take less risk, we use

the equity ratio to control for capital risk. In this paper, we also use several macroeconomic variables to control for economic development and business cycle of the economy. Since, in the last decade, World economies have experienced substantial volatility, we use GDP to control for economic growth. As the economic development generally coincides with an increase in financial inclusion, it is crucial to control for per capita GDP when assessing the association between financial inclusion and bank stability. Honohan (2008) argues that it would be interesting to see whether the impact of financial inclusion remains significant after controlling for per capita GDP.

Figure 4.1

Financial inclusion index of 87 countries



4.4.5 Descriptive statistics

Table 4.2A presents the descriptive statistics of the variables used in this study. The mean value of the Z-score is 3.7 with a standard deviation of 1.3, implying that on average, return on assets would have to fall by 3.7 times their standard deviation to wipe out bank equity. The fairly high standard deviation suggests that there is considerable cross-country variation in the level of bank stability. The mean negative logarithm of return volatility is 6.1. For the variable of interest, the mean of the financial inclusion index is 0.57, where penetration, availability and usage dimensions are 0.51, 0.62, and 0.12, respectively. The standard deviation of 0.30 indicates considerable heterogeneity in the inclusiveness of financial systems across our broad sample of 87 countries.

Table 4.2B reports the countries in our sample, ranked according to our index of financial inclusion. In terms of financial inclusion, South Korea (0.99), Belgium (0.98) and Japan (0.98) have the highest inclusive banking system, whereas Afghanistan (0.01), Yemen (0.02) and Malawi (0.03) have the lowest (also see Figure 4.1). On average, European countries have the highest financial inclusion (0.53) and banking stability (72.4), whereas African countries have the lowest value of 0.11 and 53.3, respectively. The average financial inclusion and banking stability of Asian and American countries are almost identical. The disparity of individual constituent contributing to the index of financial inclusion is also staggering; for example, the United Kingdom ranks 29 in the financial inclusion index but it ranks 76 in penetration and 9 in availability dimension. Therefore, using individual dimension as a proxy for financial inclusion would provide an incomprehensive picture of a country's overall inclusiveness. Table 4.3 reports the correlation matrix of the independent variables used in this paper. The positive correlation between institutional quality indexes and financial inclusion in Panel B is an additional indication of the robustness of the index measured in this study. The strong positive correlation between per capita GDP and financial inclusion further proves the robustness

of our index (see Honohan, 2008).[80]

4.5 Empirical results

First, we report the specification tests and results for financial inclusion and stability based on the IV regression model in equation (4.1). Second, we report the contingent effects of financial inclusion with bank competition on banking stability.

4.5.1 Financial inclusion and bank stability

In this section, we examine how financial inclusion affects bank stability after controlling for bank and country level variables. The results are reported in Table 4.4, where we use two different measures of bank stability. In columns 1-2 and 3-4, we regress ln(Z-score) and –ln(sd(ROA)) on financial inclusion, respectively. For the latter case, we follow Beck et al. (2013) and transform return volatility to make it directly proportional to banking stability. To check for the robustness of our results, we use two variant measures of market power denoted as C-Lerner and E-Lerner. Before choosing which estimator we should use for equation (4.1), we conduct an endogeneity test for the financial inclusion measures, which is reported at the bottom of Table 4.4. For rejecting the null hypothesis of exogeneity, we employ the IV-GMM estimator. In case we cannot reject the exogeneity of financial inclusion, we use the OLS estimator as it is more efficient. In both cases, we calculate heteroskedasticity and autocorrelation consistent (HAC) standard errors which are reported in square brackets. We test the validity of our instrumental variables as in GMM procedures using the under-identification LM test by Kleibergen and Paap (2006) and the over-identification test by Hansen (1982). The results on these tests show that the

[80] Since financial inclusion is generally related to per capita income, these two variables tend to be correlated. We computed the variance inflation factors (VIF) for each of our model estimates. VIF is equal to $1/(1-r^2)$, where r^2 is from the regression of an independent variable on the rest of the independent variables. The average VIF never exceeds 3, indicating that multicollinearity is not a cause for concern for our results (Anginer, Demirgüç-Kunt and Zhu, 2014). Furthermore, following previous studies on the determinants of financial development (e.g., La Porta, Lopez-de-Silanes, Shleifer and Vishny, 1997; Beck, Demirgüç-Kunt and Levine, 2003), as a robustness test we exclude per capita GDP in all estimations and the results are broadly consistent with the main findings of this study. The results are available from the authors upon request.

instruments used are valid as the p-value of the former (latter) requires a value lower (higher) than 0.05 to reject the null hypothesis at the 5% level.

Table 4.C1 shows the First-stage regressions of financial inclusion on instruments used in this study.[81] We find that all instruments have statistically significant effects on financial inclusion- the direct effect and interaction. Moreover, the signs and magnitudes of the coefficients are economically important, as financial inclusion increases more in markets with greater financial freedom and higher density of newly registered companies. A system with higher financial freedom and entry density would facilitate access to finance through augmenting banking competition and create a milieu for efficient financial intermediation between households, financial institutions, firms and entrepreneurs.[82] For example, to assess the economic significance of a whole set of instruments, consider column 4, at the mean for entry density (2.61), the marginal effect of financial freedom equals 0.002 (0.002-0.0001*2.61 = 0.002). This effect implies that one standard deviation above average increase in financial freedom (70.83) leads to a 0.14 unit increase in financial inclusion (equals a little less than ½ standard deviation of financial inclusion).

It is clear from the results that a more inclusive financial system is associated with greater banking stability, as indicated by its positive and significant (at the 1% level) coefficients (once again, a greater estimated Z-score indicates more stability i.e., less risk taking). Since we use the natural logarithm of Z-score, the coefficients can be interpreted as semi-elastic. In column 1, a one standard deviation increase in the index of financial inclusion, which equals 0.30, is associated with an increase in the ln(Z-score) of 189% (6.3*0.30). Put differently, our financial inclusion index lies between zero and unity, where

[81] The significant negative relationship between market power and financial inclusion in Table 4.A3 is consistent with the existing literature and should serve as another indication of the robustness of our index (see for example Carbó-Valverde, Rodriguez-Fernandez and Udell, 2009; Ryan, O'Toole and McCann, 2014).

[82] Entry density is one of the channels through which financial development fosters economic growth (Klapper, Laeven and Rajan, 2006).

a one standard deviation increase would be a substantial increase for any given economy; for a ¼ standard deviation increase in the index of financial inclusion leads to a 45% (6.4*0.07) increase in the ln(Z-score) (based on averaging the results across columns 1 and 2). The effect is economically important as it suggests that financial inclusion enhances banks to have a secure deposit base as well as wider lending opportunities. Therefore, with the inclusive financial sector, banks enjoy greater financial stability. This result also corroborates with the additional risk measures used in this study. The negative of return volatility –ln(sd(ROA)), in columns 3 and 4, is also positively related to financial inclusion, suggesting that an increase in the index of financial inclusion is associated with a reduction in return volatility.

These results are consistent with the view that a system with inclusive financial services tends to reinforce banking stability (e.g., Han and Melecky, 2013; Khan, 2011; Morgan and Pontines, 2014) and that a higher degree of financial inclusion mitigates excessive risk-taking of an individual bank. Since greater financial inclusion reduces distance between financial institutions and low-end customers it is able to decrease the probability of loan defaults, and hence bank fragility. This result is also supported by Agarwal and Hauswald (2007) and DeYoung, Glennon and Nigro (2008), who use US data and find that loan default probability increases with the distance between lender and borrowers. Recent empirical evidence also finds positive impacts from geographic diversification and reducing distance between banks and borrowers (e.g., Berger and DeYoung, 2001; Bos and Kolari, 2005; Deng and Elyasiani, 2008; Rossi, Schwaiger and Winkler, 2009). One would also expect that when financial institutions expand activities towards areas where more unbanked populations are located, they may be more likely to engage in diversified lending and have a wider source of cheaper funding through retail deposits rather than relying on volatile wholesale funding thus increasing the soundness of banks. Therefore, it can be argued that financial inclusion is good for banking stability.

Our results on control variables are also consistent with existing literature. As might be expected, larger banks, and banks with better management, higher equity capital and pricing power are more stable. Regarding country-level macro controls, the results show that banks operating in countries with higher economic growth and less income level significantly increase banking stability.

4.5.2 The interactive effect of bank competition and financial inclusion

We have shown in the previous section that financial inclusion is good for banking stability, consistent with the notion that an inclusive financial sector mitigates excessive risk taking of banks. Since the impact of lack of access to finance may rely on the competitiveness in the markets, and bank competition being one of the important determinants through which banking soundness gets affected, it is imperative to investigate how the relationship between financial inclusion and bank stability changes due to competitiveness in the markets.[83]

Recent studies show that bank competition is instrumental in broadening financial access (e.g., Petersen and Rajan, 1995; Beck, Demirgüç-Kunt and Maksimovic, 2004; Carbó-Valverde, Rodriguez-Fernandez and Udell, 2009; Chong, Lu and Ongena, 2013; Love and Martínez Pería, 2014; Ryan, O'Toole and McCann, 2014).[84] The literature is divided into two streams. The information hypothesis argues that greater market power may persuade banks to establish relationship lending and internalise benefits of supporting

[83] Numerous studies investigate the relationship between bank competition and stability with little consensus about the unambiguous direction of the relationship. Literature argues about two offsetting effects of bank competition on stability. On the one hand, the traditional competition-fragility hypothesis argues that greater competition increases banking fragility as it induces excessive risk-taking due to reduced profit margins (Keeley, 1990; Hellmann, Murdock and Stiglitz, 2000). On the other hand, competition-stability hypothesis argues that greater competition increases banking stability because it facilitates low interest rates for smoother repayment of loans, and decreases default risk of borrowers and thereby bank losses (Boyd and De Nicolo, 2005). However, we do not test the validity of either of these hypotheses, rather we investigate the relative importance of bank competition on the financial inclusion-stability relation. See Beck, De Jonghe and Schepens (2013) for detailed discussion on bank competition and stability.

[84] See DBH (2008).

informationally opaque or risky customers, and hence lead to more credit availability (Petersen and Rajan, 1995; Di Patti and Dell'Ariccia, 2004). In addition, when banks enter into a new market to facilitate access to finance, in a competitive environment, they tend to earn lower informational rents from their relationship with borrowers, decreasing incentives to monitor borrowers, which in turn leads to banking fragility (see e.g., Boot and Thakor, 1993; Allen and Gale, 2004). Recent theoretical models show that fiercer competition not only induces banks to acquire less information on borrowers (Dell'Ariccia and Marquez, 2004) but also persuades them towards more risky and opaque customers (Hauswald and Marquez, 2006). Therefore, if there is more interbank competition in an unbanked area, banks should have a portfolio of risky borrowers, again undermining their stability.

On the other hand, based on the traditional industrial organisation theory, the market power hypothesis argues that higher competition results in more loan supply ensuring lower lending rates, thereby improving credit availability (Beck, Demirguc-Kunt and Maksimovic, 2004; Carbó-Valverde, Rodriguez-Fernandez and Udell, 2009; Ryan, O'Toole and McCann, 2014). When a bank enters into a new market with high market power they may charge a higher interest rate on loans which may incentivise households and small firms to search for higher returns and make risky investments, increasing the probability of default, and hence losses for the banks. Again, it may be the case that fewer large banks with high market power in a banking system enjoying "too-big-to-fail" subsidies from safety net policies, may induce them to take excessive risk and thus destabilise the entire financial system (cf. Anginer, Demirgüç-Kunt and Zhu, 2014, and references therein). Regarding financial inclusion, this situation may get worse when large banks pursue an inclusive banking agenda without adhering to proper screening and monitoring procedures while serving low-end customers who often lack collateral and credit histories, increasing banking fragility. Therefore, in this section, we introduce an

interaction term between financial inclusion and bank competition in equation (4.1), and examine whether competition reduces or reinforces the positive relationship between financial inclusion and bank stability.

$$\begin{aligned} Bank\ Stability_{ijt} = {} & \beta_0 + \beta_1 Loan\ Ratio_{ijt} + \beta_2 Bank\ Size_{ijt} + \beta_3 Loan\ Loss\ \text{Pr}ovision_{ijt} \\ & + \beta_4 Income\ Diversification_{ijt} + \beta_5 Management\ Quality_{ijt} \\ & + \beta_6 Bank\ Equity_{ijt} + \beta_7 Bank\ Competition_{ijt} + \beta_8 Financial\ Inclusion_{jt} \\ & + \beta_9 (Financial\ Inclusion_{jt} \bullet Competition_{ijt}) + \beta_{10} GDP\ Growth_{jt} \\ & + \beta_{11} Per\ Capita\ GDP_{jt} + \alpha_i + Year_t + \varepsilon_{ijt} \end{aligned} \tag{3.7}$$

In equation (4.7), all other variables remain unchanged as in equation (4.1) except the interaction term, where we are interested in the coefficient β_9. The results of the interaction between financial inclusion and bank competition are reported in Table 4.5. Consistent with the earlier regressions, we also use IV estimator where both financial inclusion and interactive terms (i.e., financial inclusion and Lerner indices) are treated as endogenous variables, and instrumented via analogous instruments as in Table 4.4. For column 1 of Table 4.5, we find a significant positive interactive effect on banking stability. The positive coefficient suggests that the complementary effect of financial inclusion on bank stability is more pronounced in less competitive markets. Using the coefficients estimated in column 2, our result suggests that for a banking system with average market power (0.12), the marginal effect of financial inclusion is 6.6, whereas for a banking sector with market power of one standard deviation above average (0.36), the impact reaches 6.9. Translating these into changes in the banking stability, we find that a banking sector with average market power, ¼ standard deviation increase in the financial inclusion (0.07), results in an approximately 46% increase in the banking stability; whereas it is 48% if market power increases by one standard deviation above average. This finding is corroborated by the significant positive coefficients of the interaction terms in column 3

and 4. The evidence suggests that the magnitude of the positive impact of financial inclusion on banking stability increases if banks have higher market power. In other words, financial inclusion has a significant positive impact on banking stability but greater competition affects this relation adversely.

This result is not only significant statistically but also economically important as greater financial inclusion may limit the extent to which banks can or will engage in correlated risk taking activities in the absence of competition because they are able to venture into new markets, or seek new lines of business or clients. By dint of higher financial inclusion, banks have ample opportunities to offer many small loans, for which losses are negligible and predictable (see Adasme, Majnoni and Uribe, 2006), indicating an imperfect correlation of loan defaults. Recently, Martinez-Miera and Repullo (2010) show that at a lower correlation of loan defaults, greater bank competition is detrimental to bank stability, supporting our result of a positive coefficient on interaction term. Petersen and Rajan (1995) and Agarwal and Hauswald (2010) show that "relationship banking" and/or "borrower proximity" is the efficient method through which banks can collect soft information to reduce asymmetric information. As financial inclusion reduces distance and informational asymmetry, banks with market power can provide finances to less creditworthy households/firms and monitor carefully to reduce loan default rates, and thus enhance banking stability.

4.5.3 Institutional quality and financial inclusion

The impact of greater financial inclusion may depend on the larger institutional environment in which banks operate, and can potentially be fortified through better institutional quality. For example, freedom of expression, political stability, regulatory quality and rule of law may limit the extent to which banks can engage in correlated risk taking activities where the financial inclusion is lower. In this section, we examine how

the interaction between financial inclusion and each country's institutional environment affects the positive role of financial inclusion on banking stability as follows:

$$\begin{aligned} Bank\ Stability_{ijt} = {} & \beta_0 + \beta_1 Loan\ Ratio_{ijt} + \beta_2 Bank\ Size_{ijt} + \beta_3 Loan\ Loss\ \Pr ovision_{ijt} \\ & + \beta_4 Income\ Diversification_{ijt} + \beta_5 Management\ Quality_{ijt} \\ & + \beta_6 Bank\ Equity_{ijt} + \beta_7 Bank\ Competition_{ijt} + \beta_8 Financial\ Inclusion_{jt} \\ & + \beta_9 Institutional\ Quality_{jt} + \beta_{10}(Financial\ Inclusion_{jt} \bullet Institutional\ Quality_{jt}) \\ & + \beta_{11} GDP\ Growth_{jt} + \beta_{12} Per\ Capita\ GDP_{jt} + \alpha_i + Year_t + \varepsilon_{ijt} \end{aligned} \quad (3.8)$$

In equation (4.8), we add six indicators of institutional quality taken from Kaufmann, Kraay and Mastruzzi's (2010) *Governance Index*. As these indicators are highly correlated, we run regression using each indicator and its interaction term with financial inclusion one at a time to avoid the multicollinearity problem. However, we capture common variation among these six governance indicators using the principal component analysis and construct a composite index of institutional quality (IQI). For the sake of simplicity, we use logarithm of Z-score as the dependent variable keeping all other bank and macro controls analogous.[85] The financial inclusion and the interaction term are treated as endogenous and instrumented via variables that are reported at the bottom of Table 4.6 with the main results. For expositional brevity, and because we are interested in the interaction effects, the results of the controls are not reported.

Most of the interaction terms enter positively and significantly at the 5% level. Columns 1, 2, 4, and 5 of Table 4.6 suggest that the benefit of having greater freedom of expressions and free media (Voice), political stability (Political), regulatory quality (Regulatory), and rule of law (Law) in reducing bank risk-taking is more pronounced in the markets where financial inclusion is higher. At the bottom of the table, we report the

[85] In all these regressions, we use efficiency adjusted Lerner indices as the proxy of bank competition.

marginal effect of financial inclusion at the mean of each indicator. Column 6 shows that at the mean value of control of corruption greater financial inclusion reduces banking fragility. In column 7, we use the first principal component (the only component that has an eigenvalue of more than one i.e., 5.27 with 87% variation) of all institutional variables (e.g., Voice, Political, Government, Regulatory, Law and Corruption) and create a composite index of 'Institutional Quality' and run the regression. The interaction term in column 7 also confirms our results that the positive impact of institutional quality on reducing risk is higher if banks operate in an inclusive financial system.

In terms of the economic significance, the magnitude of the coefficient suggests that there is a significant effect of financial inclusion on banking stability in the countries with the highest levels of institutional development. For instance, using estimated coefficients in column 7, the derivative (partial) of bank stability with respect to financial inclusion at the mean level of our composite institutional quality index (IQI) is 10.88 (significant at the 1% level). The same derivative evaluated at the 25^{th} percentile (lower) of institutional quality index is 6.24 (significant at the 1% level). On the other hand, when the institutional quality index is at the 75^{th} percentile (higher), it increases by more than two factors (15.22) (significant at the 1% level). *Translating these into changes in the banking stability, we find that in a country with lower institutional quality, ¼ standard deviation increase in the financial inclusion (0.07) results in an approximately 46% increase in the banking stability. However, in a country with higher institutional quality, we observe a substantial increase of 112% on banking stability.* These findings are consistent with existing empirical literature as Beck, Demirgüç-Kunt and Maksimovic (2005) show that greater institutional development (e.g., financial, legal and corruption) facilitates better access to finance especially for the smallest firms. For example, a more effective rule of law provides more flexibility in terms of contract enforcement without much delay. Overall, the positive interactive effects seem to suggest that the beneficial

effects of financial inclusion on banking stability reinforces if the market within which banks operate have greater quality of institutional settings.[86]

4.5.4 Additional sensitivity analysis

In this section, we discuss the various additional robustness tests of our study. In each specification, we conduct an endogeneity test. In case it is not statistically significant at the 5% level, we use ordinary least squares regression as it is more efficient. The definitions of the rest of the variables are the same as in equation (4.1). At the bottom of each table, we report the Kleibergen and Paap (2006) test for weak instruments and the Hansen over-identification test.

4.5.4.1 Alternative financial inclusion index

Although we construct a financial inclusion index incorporating as many dimensions as possible, given the data availability constraints it is possible that our results are inferred incorrectly because of a poorly constructed index. Therefore, we use an alternative financial inclusion index that is taken from the Global Findex Database, which collects information on how people in 148 countries manage their financial activities. The variable we use as the financial inclusion proxy is the percentage of adults that had savings at a financial institution in the year prior to the survey (see e.g., Demirgüç-Kunt, Klapper and Singer, 2013; Allen, Carletti, Cull, Senbet and Valenzuela, 2014). This database is new and just covers the year 2011. We had to collapse our dataset at bank-level to run two-stage cross-sectional instrumental variable regressions. Global Findex and its interaction with Lerner indices are treated as endogenous variables. These variables are instrumented via the financial freedom, entry density and their interactions. The regression results are

[86] Interestingly, we find that the derivative of ln(Zscore) with respect to financial inclusion at the minimum level of institutional quality (i.e., -6.30) is -3.89, whereas the derivative of ln(Zscore) with respect to institutional quality at the minimum level of financial inclusion (i.e., 0.008) is -0.59, suggesting institutional quality has a greater impact on banking stability than financial inclusion (see Baltagi, Demetriades and Law, 2009, p295).

presented in Table 4.7, showing that the relationship between Global Findex and bank stability is still positive and statistically significant. Regarding the interactive effect, it also corroborates with the earlier finding that the positive impact of financial inclusion on bank stability is robust in less competitive markets. It reiterates that financial inclusion is good for banking stability.

4.5.4.2 Alternative banking stability measure

Following Beck, De Jonghe and Schepens (2013), we use an alternative measure of bank stability in which the denominator in equation (4.2) is calculated using five year rolling windows. As usual, financial inclusion is instrumented via the financial freedom, entry density and their interactions. The results are reported in Table 4.8. The main results remain unaltered with a slight increase in the magnitude of the coefficients.

4.5.4.3 Split samples based on financial inclusion

We split our sample into terciles according to the financial inclusion index and re-run six regressions.[87] The results are reported in Table 4.9 (column 1-6). The low, medium and high terciles of financial inclusion are instrumented via the investment freedom (ranges 0-100, higher value implies less constraint on the flow of investment capital) entry density and investment freedom times entry density (the result of the first-stage regression is available from the authors). The result indicates that the effect of financial inclusion at the lower terciles is negative with banking stability. It becomes significant at the medium terciles. We can see that the magnitude of the coefficient of the highest terciles is twofold higher than medium terciles. This is consistent with our argument that a greater inclusive

[87] The summary statistics of the group with the lowest financial inclusion index has an average (median) bank stability (Z-score) of 70.2 (34.3), the group with the medium financial inclusion index has an average (median) bank stability of 94.8 (45.9), and the group with the highest financial inclusion index has an average (median) bank stability of 138.8 (56.1).

banking sector is good for the soundness of banks.

4.5.4.4 Different sample selection

We also conduct a battery of sensitivity checks using different sample selection criteria such as excluding cooperative and Islamic banks, excluding Japan and Italy, and finally excluding developed countries. Our dataset comprises 1549 commercial banks, 1084 cooperative banks and 37 Islamic banks. We drop all cooperative and Islamic banks from our dataset and keep only commercial banks. The result of the regressions, which is reported in Table 4.9 (columns 7 and 8), shows that the magnitude of the positive effects of financial inclusion on banking stability is even higher in the case of only commercial banks, reiterating the beneficial effect of financial inclusion on the soundness of banks. The number of banks in Japan and Italy is 457 and 489 respectively, which constitutes the lion's share of our sample. We drop these two countries and re-run regressions, which are reported in Table 4.9 (columns 9 and 10). Dropping Japan and Italy does not alter the main findings of this study. Finally, we also drop all banks of the developed countries keeping only 708 banks that operate in developing countries, and re-run regressions. The result also corroborates the earlier findings that financial inclusion is good for banking stability.

4.6 Enabling inclusive financial environment: difference-in-differences approach

In this section, we exploit the exogenous variation of developing countries' membership timing into a global network of policymakers with an inclusive finance agenda, and evaluate the effects of enabling an inclusive financial environment on banking stability by using both parametric (difference-in-differences) and non-parametric matching estimators while employing bank— and country—level data.

In the aftermath of the global financial crisis that took place in 2008, the leaders of the Group of Twenty (G20) recognised the mutually reinforcing policy objectives of

financial inclusion, stability and consumer protection.[88] They committed to increasing the access of the disadvantaged groups to financial services through principles for innovative financial inclusion at the ***Pittsburgh Summit in 2009***. These principles were drafted by three financial inclusion expert groups namely the Alliance for Financial Inclusion (funded by the Bill and Melinda Gates Foundation), the Consultative Group to Assist the Poor (CGAP), and the World Bank Group's private financing arm, the International Finance Corporation (IFC) (Soederberg, 2013). Among these expert groups, AFI was founded in 2008 and known as the first global knowledge sharing network for policymakers on financial inclusion. At present, AFI's network is composed of central banks and other financial institutions from more than 90 countries. In 2011, to complement G20 principles, the Maya Declaration was signed by a group of developing country regulatory institutions at the third Global Policy Forum of the AFI held in Mexico to strengthen and expand financial inclusion policy (see Table 4.D1 for details on the G20 principles and Maya Declaration commitments). However, we find 30 out of 87 countries in our sample became members of the AFI network after the first Global Policy Forum of ***AFI held in Nairobi in 2009***. Since they had become members of this network, they could share knowledge on financial inclusion as well as develop and implement policies designed to expand the access of the poor people to financial services. Since then, broadening financial inclusion has become an important policy objective for these member countries and has set the stage for many enabling laws and regulations to support the poor.[89]

[88] http://www.afi-global.org/sites/default/files/afi%20g20%20principles.pdf

[89] The list of supporting laws and regulations that have been taken by developing countries to broaden financial inclusion is exhaustive and not limited to the following selective instances. In 2009, Pakistan created a consultative group on branchless banking and launched a risk sharing facility for small and rural enterprises; Fiji established a national taskforce on financial inclusion and agreed on a medium-term financial inclusion strategy to reach 150,000 unbanked. In 2010, Bangladesh established microcredit regulatory authority regulations; Ethiopia developed a growth and transformation plan that includes a national financial inclusion strategy; and Morocco implemented a financial inclusion strategy. In 2011, El Salvador passed a law appointing the Central Bank the head of public policies on the financial system, including financial inclusion; Mexico created the National Council for Financial Inclusion (CONAIF) through Presidential Decree; Democratic Republic of Congo launched mobile banking services. In 2012, Bangladesh began licensing mobile banking; Brazil launched an action plan for the national partnership for

Since the banks of these member countries are exposed to various financial access policies, we assume that the changing inclusive financial environment will have a discernible effect on the risk-taking of the banks. Therefore, using bank- and country-level data, we investigate whether the financial access policies have any effect on banking stability applying a difference-in-differences approach as follows:

$$\begin{aligned} Bank\ Stability_{ijt} = {} & \alpha_0 + \alpha_i + \gamma(Financial\ Access\ Policy)_{jt\text{-}1} + \beta_1 Loan\ Ratio_{ijt} + \beta_2 Bank\ Size_{ijt} \\ & + \beta_3 Loan\ Loss\ \text{Pr}ovision_{ijt} + \beta_4 Income\ Diversification_{ijt} \\ & + \beta_5 Management\ Quality_{ijt} + \beta_6 Bank\ Equity_{ijt} + \beta_7 Bank\ Competition_{ijt} \\ & + \beta_9 GDP\ Growth_{jt} + \beta_{10} Per\ Capita\ GDP_{jt} + Year_t + \varepsilon_{ijt} \end{aligned} \tag{3.9}$$

where i indexes bank, j indexes countries, and t indexes years. $Bank\ stability_{ijt}$ is the financial stability of banks as defined earlier. The country and year fixed effects are denoted as α_j and α_t, respectively (we also use bank fixed effects as a robustness test in Table 4.10). The analogous bank—and country—specific controls are used as in equation (4.1). Lagged values of efficiency adjusted Lerner indices are used as the proxy for bank competition in order to eliminate any endogeneity issue. $Financial\ Access\ Policy_{jt\text{-}1}$ is an indicator variable that takes a value equal to one if the bank is in a country that became a member of AFI's network in 2009 and thereafter or else zero (see Table 4.D2 for membership timing across countries). In this case, our variable of interest is γ. If exposure to AFI's network (i.e., becoming a member of the AFI network) is congenial to broadening financial inclusion, then the estimated coefficient of banking stability will show a positive outcome. This coefficient captures the sensitivity of the dependent variable to the changes in financial inclusion between a group of countries that is exposed to a treatment

financial inclusion; Colombia undertook a massive expansion of mobile financial services and expanded the number of banking agents; India, issued policy guidelines for expanding the banking network to unbanked customers.

(henceforth treated) and a group that is not exposed to the treatment (henceforth control) after becoming a member of the AFI network.[90] This approach is particularly suitable for identifying causal effects of an exposure (in our case, the exogenous variation in the timing of membership of AFI) on groups that are affected by the institutional settings with those that are not affected. Since we are controlling both groups before and after the events and the same group is acting as control and treated in this methodology we are able to control for both observable and unobservable factors that may have changed over time as well. By doing so, we are able to eliminate any bias that emanates from changes other than the AFI's network that could have affected the treated group (Imbens and Wooldridge, 2009). A similar type of regression is used by Jayaratne and Strahan (1996) and Koetter, Kolari and Spierdijk (2012) on cross-state setup for the US banking sector, and Haselmann, Pistor and Vig (2010) on cross-country setup for East European countries.

For the DID approach to be meaningful, there are two aspects that should be taken into consideration. First, the changes in the efforts of broadening financial inclusion need to be exogenous and second, comparison groups should be homogeneous. The first issue of whether changes in the efforts of financial inclusion are exogenous or endogenous has little effect on our DID result as most of the policy suggestions were encouraged by various multilateral organisations (e.g., G20, AFI and World Bank). This shows the exogenous nature and randomness in embracing innovative access policy initiatives. In addition, endogeneity is less of a concern for our analysis as we investigate the impact of a country-level indicator on bank-level stability. We are mostly concerned with the second issue of getting a comparison group that should serve as a valid counterfactual. To eradicate selection bias and confounding factors, in the spirit of Ho, Imai, King and Stuart (2007), we use propensity score matching, developed by Rosenbaum and Rubin (1983) to get a

[90] For details on this methodology see Haselmann, Pistor and Vig (2010).

matched comparison group and then run difference-in-differences regression on the matched sample. This doubly robust technique provides unbiased estimates of the treatment effects even if either or both of the procedures are correctly specified and could be considered exposure similar to that from a randomised trial (Funk, Westreich, Wiesen, Stürmer, Brookhart and Davidian, 2011). This approach also allows us to estimate the treatment effects while controlling for both observed and unobserved bank- and country-specific characteristics. First, we adopt a nearest-neighbor logit propensity score matching strategy to identify non-member countries of AFI which are similar to the member countries on the basis of observable characteristics.[91] Second, each member country of AFI is matched with a non-member country that has the closest propensity score within a given caliper (i.e., threshold). Third, regressions are run on the matched sample using difference-in-differences approach.

Panel A of Table 4.10 reports the results of DID estimation on a matched sample. In all specifications, year dummies are included to control for the business cycle. Standard errors are clustered at the country-level as omitted country characteristics might cause error terms to be correlated for banks within the same country. While we control for country fixed effects in columns 1-4, we consider bank fixed effects in columns 5-8. The result shows that financial stability of the banks that operate in the treated countries has increased substantially following the changes in financial access policies. As columns 1 and 3 show that the indicator *Financial Access Policy* is positive and significantly related with banking stability, to reduce the residual variance while increasing efficiency of the DID results, we use the analogous controls as in equation (4.1) in columns 2 and 4. The outcomes are robust even after controlling for bank- and country-specific control variables. The economic

[91] Observable characteristics are the industry average total asset, GDP per capita, GDP growth rate, financial freedom, and regulatory quality. Balancing tests are satisfied and reported along with the Logit model in Table 4.D3. Figure 4.D1 shows the propensity score matching blocks and matched distribution.

impact of the financial access policies on banking stability is considerable. The increasing efforts of having an inclusive financial system have improved the soundness of the banks that operate in the treated countries by 36%.[92] The results also corroborate when we control for unobserved bank-specific characteristics in columns 5-8.

To further alleviate any potential selection bias and confounding in the treatment effects, that might yet remain in the DID results, we use two other matching techniques (i.e., kernel and stratification) and the recently developed covariate matching estimator of Abadie and Imbens (2006) to estimate the average treatment effect for the treated (ATT).[93] For the latter case, ATT is estimated to match on four nearest neighbours (Abadie, Drukker, Herr and Imbens, 2004). The advantage of this approach is that it employs covariates to match treatment group and control group.[94] It also corrects for bias if matching is imperfect, and calculates heteroskedasticity robust standard errors of the treatment effects without making any assumption about the functional form.

Panel B of Table 4.10 reports the results of the matching estimators. In all matching estimators, we impose common support condition to restrict control groups to fall within the support of the propensity score distribution of the treated groups. The result corresponds to the earlier findings that after a change in the effort to have an inclusive financial system, the stability of the banks that operate in the treated countries increases by 42% (averaging across all matching estimators). The results once again reiterate that an inclusive financial sector has causal effects on the soundness of banks. The result is also consistent with the economic rationale that greater institutional pursuit of financial

[92] We follow Halvorsen and Palmquist (1980), and calculate the effect of the indicator variable (i.e., *AFI*) averaging across columns 1-4 as $(\exp(\gamma)-1)$, where γ is the coefficient of interest in our semi-logarithmic equation.

[93] While kernel matching estimator matches the treated units with weighted average of all control units, with weights that are inversely proportional to the distance in terms of their propensity score, stratification matching estimator divides the common support into different strata and measures the treatment's effect within each interval. For details on the matching methods see Lin and Ye (2007) and De Mendonça and De Souza (2012).

[94] In Abadie and Imbens, we use similar pre-treatment characteristics as in Table 4.D3 for matching.

inclusiveness helps reduce the informational asymmetry between borrowers and lenders.

We subject our findings to a series of additional sensitivity checks. The results are robust to (i) using an alternative measure of financial inclusion that is taken from the Global Findex database, (ii) using an alternative measure of bank stability, which is calculated taking five year rolling windows of standard deviation of return on assets, (iii) dropping cooperative banks and Islamic banks from the sample, where regressions are run keeping only commercial banks, (iv) dropping countries (e.g., Japan and Italy) that constitute the lion's share of the sample, (v) running regressions only for the sample of developing country, and finally (vi) exploiting exogenous variation in the membership timing of a network of policymakers embracing financial inclusion, and investigating the causal effect of enabling an inclusive financial environment on banking stability. For all of these alternative setups the main findings of this study largely remain unaltered.

4.7 Concluding remarks and policy implications

Broadening the access of the disadvantaged groups to a formal financial system has numerous benefits as documented in the literature, including greater efficiency in the allocation of resources, social and political stability and more innovation. When the financial system becomes more inclusive, this generally results in greater opportunity for banks to diversify lending and funding strategies while reducing distance, facilitating a strong relationship with customers who were previously excluded from the formal financial system. But, since expanding the access of low income groups to financial services is perceived as risky, whether financial inclusion is complementary or antagonistic to the issue of bank stability remains the subject of a continuing debate among academics and policymakers alike both from a theoretical and from an empirical perspective.

This paper has therefore contributed to this debate addressing a contemporary

policy issue related to financial development, financial inclusion and bank stability, using an international sample of 2,913 banks in 87 countries for the period 2004-2012. First, we constructed a new country-level composite index of financial inclusion using principal component analysis, and ranked countries based on the score of this index. Despite the shortcomings of data availability, the constructed index has good predictive power in tracking the micro-level indicators of global financial inclusion such as the share of households with savings and bank accounts at formal financial institutions. Second, given the changing milieu of banking operations, where formal financial institutions increasingly search for new opportunities and markets and see the benefits of a micro-finance style of operations, this is the first study to investigate such an important issue to provide some understanding on the access to finance and bank stability nexus. Therefore, considering the overriding interest of inclusive economic growth and relatively substantive emphasis on the financial stability in the post crisis era, this study investigated the influence of an inclusive financial system on banking stability in a panel setting once other factors are controlled for. Third, since one of the tasks of bank regulation is to curb the adverse effect of banking competition on stability (see Beck, De Jonghe and Schepens, 2013), we also checked whether the relationship between financial inclusion and bank stability changes due to higher competition, as measured by the lower level of Lerner indices of two variants. Fourth, we checked whether the institutional settings in which banks operate have any influence on the access-stability relationship. Finally, we subject our findings to an array of sensitivity checks including splitting sample into terciles based on the financial inclusion index, using alternative measures of banking stability and financial inclusion, and using different sample specifications, particularly running regression on the sample of developing countries. We also exploited the exogenous variation in the membership timing of developing countries' network of financial inclusion policymakers and explored whether enabling an inclusive financial environment has any causal effect on banking

stability, using parametric (difference-in-differences) and non-parametric matching estimators.

Our results indicate that there is a strong link between financial inclusion and bank stability; in particular, the higher the degree of financial inclusion the better the banking stability. The evidence also suggests that any beneficial effects of financial inclusion on bank stability tend to be more pronounced in banking sectors with less competition. As banks expand operations towards new markets to serve previously underserved and/or excluded adult populations, they are able to reduce excessive risk taking if the environment in which they operate is less competitive. Furthermore, investigating the influence of institutional settings on the access-stability relationship, we also find that the positive impact of financial inclusion on stability reinforces if the country in which banks operate has greater institutional quality. Specifically, greater freedom of expression, political stability, regulatory quality, rule of law and less corruption enhances the positive relationship between financial inclusion and bank stability. The DID approach shows that supporting an inclusive financial system increases the soundness of banks of the treated countries by almost 36%.

Our results have important policy implications. The findings suggest that banking stability is strongly influenced by the degree to which the poorest of the poor individuals and small enterprises have access to basic financial services, which indicates the importance of ensuring an inclusive financial system. An inclusive financial system will allow banks to exploit the untapped potential of customers who were previously unbanked or under-banked, and strengthen their balance sheets making them more resilient against a possible future shock. Since expanding access to financial services is a key ingredient of financial development strategies, the concerted and sustained efforts of formal financial institutions to allocate resources in more productive areas of the economy would make

them more profitable. Existing evidence supports this notion that average profitability is higher if lenders provide loans repeatedly to the same customer because of less default probability associated with experienced borrowers (see Karlan and Zinman, 2010). As only 41% of people in the developing countries compared to 89% in developed ones have bank accounts (see Demirgüç-Kunt and Klapper, 2012), additional policies should focus on ensuring access for all of the excluded to formal financial services, especially in the developing ones.

Furthermore, our results also stress the importance of the underlying competitive and institutional framework. The beneficial effects of financial inclusion on bank stability are greater in the countries where the market power of banks and the country's institutional qualities are high. In this respect, since competition is perceived to be instrumental to broadening access to finance but detrimental to banking stability, broadening access without paying attention to potential negative consequences of competition on financial stability is obviously suboptimal. Therefore, it is important for the authorities to strike the right balance between financial inclusion and bank competition while avoiding stepping into financial fragility. They should also continue their efforts of establishing an institutional environment that will complement the access-stability nexus. In the end, however, only more empirical research using both supply and demand-side data on access will provide a comprehensive picture of the effects of financial inclusion on banking stability and whether bank competition and institutional quality reduces or reinforces this relation.

Table 4.1

Variable Definitions and Sources

Variable	Definitions	Source
Dependent Variables		
Z-score	Sum of return-on-assets (ROA), defined as net profit over assets, and equity ratio (EQA), defined as equity over assets, divided by standard deviation of (ROA) of each bank over the past three years (calculated using a rolling window)	BankScope
Volatility of ROA	Standard deviation of ROA for each bank, calculated over the past 3 years	BankScope
Financial Inclusion		
Penetration	The number of deposit and loan accounts per 1000 adults	IMF
Availability	The outreach dimension constructed using principal component analysis (PCA) from the variables related to geographic and demographic availability	Authors' calculation
Usage	Total volume of deposit and loans relative to GDP	IMF
Financial inclusion index	Financial inclusion index is constructed using PCA from the penetration, availability and usage dimensions.	Authors' calculation
Bank competition		
C-Lerner	A bank-level non-structural indicator of bank competition, measured by using a stochastic frontier analysis approach assuming full bank efficiency, with lower values indicating higher competition in the banking sector	Authors' calculation
E-Lerner	A bank-level non-structural indicator of bank competition, an efficiency-adjusted Lerner index, measured by using a stochastic frontier analysis approach, with lower values indicating higher competition in banking	Authors' calculation
Firm-specific variables		
Access to finance	Dummy variable equal to 1 if the firm has access to bank finance (loan, overdraft or line of credit)	WBES
Financing Obstacle	Financing obstacle is defined on a five point scale of how problematic financing is for the operation and growth of business: (0) No obstacle (1) minor obstacle (2) moderate obstacle (3) major obstacle, and (4) very severe	WBES
Firm size (employees)	The number of permanent full-time employees	WBES
Manufacturing	Dummy variable equal to 1 if the firm is in the manufacturing sector	WBES
Exporter	Dummy variable equal to 1 if 10 percent or more of sales are exported directly or indirectly by the firm	WBES
Foreign-owned	Dummy variable equal to 1 if 50 percent or more of the firm is owned by foreign organizations	WBES
Government-owned	Dummy variable equal to 1 if 10 percent or more of the firm is owned by the government	WBES
Firm age	Age of the firm in years	WBES
Bank-specific variables		
Loan ratio	Total performing loans divided by total assets	BankScope
LLP ratio	Total loan loss provision divided by total assets	BankScope
Income diversification	Non-interest income divided by total operating income	BankScope
Management quality	Total earning assets divided by total assets	BankScope
Equity ratio	Total equity divided by total assets	BankScope
IV Instruments		
Financial freedom	This indicator shows the degree of openness of the banking system. It is a multidimensional index of whether government interference exists in the financial sector, such as regulation, financial products, allocation of credit, whether foreign banks are free to operate. Higher values indicate fewer restrictions on banking freedoms	Heritage Foundation (2014)
Labor freedom	The labor freedom component is a quantitative measure that considers various aspects of the legal and regulatory framework of a country's labor market, including regulations concerning minimum wages, laws inhibiting layoffs, severance requirements, and measurable regulatory restraints on hiring and hours worked. Higher values indicate fewer restrictions on labour freedom	Heritage Foundation (2014)
Entry density	Entry density is a variable referring to the number of newly registered companies with limited liability per 1,000 working-age people (those aged 15-64).	Doing Business database
Credit information depth	Credit information depth is a variable that ranges from zero to six, with higher values indicating deeper credit information.	Entrepreneurship Database
Macroeconomic variables		
GDP growth rate	The growth rate of GDP	World Bank
GDP per capita	The natural logarithm of per capita GDP	World Bank
Voice and accountability (Voice)	The indicator measures the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and free media. Higher values mean greater political rights	Kaufmann, Kraay and Mastruzzi (2010)

Variable	Definitions	Source
Political stability (Political)	The indicator measures the perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including political violence and terrorism. Higher values mean more stable political environment	Kaufmann, Kraay and Mastruzzi (2010)
Government effectiveness (Government)	The indicator measures the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. Higher values mean higher quality of public and civil service	Kaufmann, Kraay and Mastruzzi (2010)
Regulatory quality (Regulatory)	The indicator measures the ability of the government to formulate and implement sound policies and regulations that permit and promote market competition and private-sector development. Higher values mean higher quality of regulation	Kaufmann, Kraay and Mastruzzi (2010)
Rule of law (Law)	The indicator measures the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, the police, and the courts, as well as the likelihood of crime and violence. Higher values mean stronger law and order.	Kaufmann, Kraay and Mastruzzi (2010)
Control of corruption (Corruption)	The indicator measures the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as the ''capture'' of the state by elites and private interests. Higher values indicate better control of corruption.	Kaufmann, Kraay and Mastruzzi (2010)
Institutional quality index (IQI)	Institutional quality index is constructed using principal component analysis from the Voice, Political, Government, Regulatory, Law, and Corruption indexes of Kaufmann, Kraay and Mastruzzi (2010)	Authors' calculation

Table 4.2A

Summary Statistics

This table shows the total sample summary statistics for the bank-specific variables, macroeconomic variables and the variables that are used as instruments in the instrumental variable regressions throughout the paper. Bank-level data is compiled from BankScope. Macroeconomic data is retrieved from the World Bank World Development Indicator (WDI). The IV instrument financial freedom and labour freedom are obtained from the Economic Freedom Indicators of Heritage Foundation (2013). Entry density and credit information depth are taken from Doing Business and Entrepreneurship Database of the World Bank, respectively. The full sample contains 13836 observations. This table consists of six parts. The descriptive statistics of the dependent variables which are used to proxy for stability of individual banks are in the first part. The financial inclusion index and its three dimensions are in the second part of this table. The third part contains market power variables, which is proxied by two variants of Lerner indices: conventional Lerner (i.e., C-Lerner) and efficiency-adjusted Lerner (i.e., E-Lerner). Bank-specific variables are in the fourth part. IV instruments are in the fifth part of this table followed by the macroeconomic variables in the sixth.

Variable	Mean	Median	SD	Min	Max	N
Dependent Variables						
Z-score	3.718	3.759	1.345	0.298	7.718	13836
Volatility of ROA	6.078	6.008	1.414	0.811	12.126	13836
Financial Inclusion						
Penetration	0.512	0.375	0.349	0	1	13836
Availability	0.625	0.794	0.339	0.007	0.999	13836
Usage	0.115	0.004	0.221	0	1	13836
Financial inclusion index	0.573	0.609	0.296	0.008	0.984	13836
Market Power						
C-Lerner	0.051	0.086	0.286	-1.39	0.801	13836
E-Lerner	0.125	0.142	0.243	-0.754	0.876	13836
Firm-level variables						
Access to Finance	0.607	1.000	0.489	0.000	1.000	38987
Financing Obstacle	1.538	1.000	1.362	0.000	4.000	38987
Log Firm Size (employee)	2.548	2.303	1.494	0.000	11.513	38987
Exporter	0.204	0.000	0.403	0.000	1.000	38987
Manufacturing	0.578	1.000	0.494	0.000	1.000	38987
Foreign Owned	0.102	0.000	0.303	0.000	1.000	38987
Government Owned	0.025	0.000	0.156	0.000	1.000	38987
Log Firm age	3.006	2.944	0.547	0.693	5.366	38987
Bank-specific variables						
Loan ratio	0.554	0.569	0.19	0	0.998	13836
Total assets	7.119	6.958	1.899	-1.834	14.912	13836
LLP ratio	0.012	0.006	0.037	-0.277	2.693	13836
Income diversification	0.162	0.135	0.816	-24.25	82.214	13836
Management quality	0.907	0.947	0.096	0.028	1.105	13836
Equity ratio	0.109	0.088	0.087	0	0.934	13836
IV Instruments						
Financial freedom	56.793	60	14.036	10	90	13836
Labor freedom	67.197	70.4	15.319	20	100	13836
Entry density	2.613	1.677	3.747	0.027	39.001	11939
Credit information depth	4.689	5	1.598	0	6	13784
Macroeconomic variables						
GDP growth rate	0.019	0.018	0.04	-0.18	0.226	13836
GDP per capita	9.519	10.28	1.349	4.986	11.124	13836

Table 2B
The estimation results for the banking stability and financial inclusion. Source: Author's calculation.

Country	Z-score	Financial inclusion index	Penetration	Availability	Usage	No. of Banks
Asia						
Afghanistan	16.83	**0.012 (87)**	0.015 (80)	0.01 (87)	0.015 (37)	9
Armenia	48.67	0.224 (56)	0.254 (51)	0.187 (51)	0.097 (18)	14
Azerbaijan	29.07	0.136 (65)	0.121 (61)	0.134 (63)	0 (86)	21
Bangladesh	79.28	0.46 (23)	0.32 (41)	0.594 (16)	0.08 (19)	12
Cambodia	42.98	0.072 (74)	0.023 (77)	0.043 (77)	0.906 (4)	12
Cyprus	27.84	0.365 (37)	0 (83)	0.732 (13)	0.001 (67)	13
Georgia	21.59	0.285 (47)	0.385 (30)	0.187 (52)	0.001 (69)	12
Hong Kong SAR, China	81.60	0.389 (31)	0 (83)	0.775 (10)	0.037 (26)	28
India	94.71	0.373 (35)	0.317 (42)	0.421 (23)	0.025 (33)	62
Indonesia	59.24	0.233 (54)	0.286 (48)	0.097 (67)	1 (1)	61
Japan	124.72	**0.977 (3)**	1 (1)	0.937 (4)	0.195 (14)	457
Jordan	102.00	0.272 (48)	0.382 (32)	0.167 (54)	0.001 (72)	12
Kazakhstan	59.26	0.304 (44)	0.488 (23)	0.116 (65)	0.065 (23)	27
Korea, Rep.	57.60	**0.991 (1)**	0.927 (6)	0.992 (1)	1 (1)	14
Kuwait	52.57	0.292 (46)	0.294 (46)	0.292 (32)	0 (87)	12
Lebanon	109.28	0.496 (18)	0.347 (37)	0.555 (18)	1 (1)	33
Malaysia	46.29	0.48 (21)	0.709 (13)	0.251 (38)	0.005 (46)	14
Mongolia	31.58	0.421 (26)	0.336 (39)	0.285 (33)	0.652 (7)	3
Pakistan	55.04	0.076 (73)	0.079 (64)	0.074 (70)	0.021 (34)	11
Philippines	68.94	0.116 (66)	0.089 (63)	0.141 (60)	0.032 (30)	22
Saudi Arabia	55.85	0.271 (49)	0.373 (33)	0.141 (62)	0.002 (63)	12
Singapore	84.71	0.368 (36)	0 (83)	0.736 (12)	0.003 (50)	13
Thailand	78.85	0.475 (22)	0.652 (15)	0.295 (31)	0.037 (25)	21
Turkey	56.40	0.524 (16)	0.812 (11)	0.236 (41)	0.001 (77)	27
United Arab Emirates	76.16	0.296 (45)	0.345 (38)	0.214 (48)	0.003 (53)	24
Uzbekistan	85.38	0.138 (64)	0.01 (82)	0.233 (42)	0.404 (9)	9
Yemen, Rep.	43.20	**0.021 (86)**	0.02 (78)	0.018 (86)	0.037 (27)	6
Average/Total	**62.58**	**0.336**	**0.318**	**0.328**	**0.208**	**961**
Europe						
Austria	112.13	0.354 (39)	0.274 (49)	0.434 (22)	0.001 (79)	158
Belgium	79.91	**0.981 (2)**	0.939 (4)	0.961 (2)	0.002 (56)	27
Bosnia and Herzegovina	91.98	0.312 (43)	0.327 (40)	0.264 (35)	0.001 (73)	19
Bulgaria	46.98	0.711 (8)	0.835 (9)	0.586 (17)	0.002 (59)	17
Croatia	81.44	0.386 (33)	0.261 (50)	0.459 (20)	0.003 (49)	29
Estonia	46.91	0.618 (11)	0.931 (5)	0.3 (30)	0.008 (40)	7
Finland	53.05	0.542 (15)	0.885 (8)	0.252 (37)	0.001 (78)	10
Greece	59.62	0.545 (14)	0.627 (17)	0.457 (21)	0.001 (66)	10
Hungary	49.68	0.417 (27)	0.412 (28)	0.407 (24)	0.186 (15)	22
Iceland	26.78	0.206 (58)	0 (83)	0.401 (25)	0.139 (17)	5
Ireland	38.98	0.489 (20)	0.368 (35)	0.611 (15)	0.001 (64)	8
Italy	92.70	0.564 (12)	0.184 (54)	0.944 (3)	0.001 (82)	489
Latvia	22.59	0.393 (30)	0.482 (24)	0.305 (29)	0.001 (75)	19
Macedonia, FYR	52.70	0.492 (19)	0.685 (14)	0.247 (39)	0.027 (32)	13
Malta	131.28	0.921 (4)	1 (1)	0.841 (7)	0.001 (65)	7
Moldova	34.96	0.327 (42)	0.528 (20)	0.126 (64)	0.005 (45)	12
Montenegro	64.28	0.386 (32)	0.429 (26)	0.307 (28)	0.001 (71)	7
Netherlands	67.89	0.83 (5)	0.913 (7)	0.747 (11)	0.001 (74)	27
Norway	40.00	0.089 (69)	0 (83)	0.179 (53)	0.015 (38)	12
Portugal	31.27	0.785 (7)	0.647 (16)	0.923 (5)	0.002 (61)	18
Serbia	36.48	0.385 (34)	0.401 (29)	0.337 (27)	0.073 (21)	28
Spain	115.74	0.816 (6)	0.752 (12)	0.879 (6)	0.001 (68)	89
Switzerland	330.24	0.694 (9)	0.585 (18)	0.803 (8)	0.002 (54)	124
Ukraine	38.50	0.52 (17)	0.824 (10)	0.202 (50)	0.004 (48)	14
United Kingdom	62.97	0.405 (29)	0.026 (76)	0.785 (9)	0 (83)	95
Average/Total	**72.36**	**0.527**	**0.533**	**0.510**	**0.019**	**1266**
Americas						
Argentina	38.53	0.256 (51)	0.373 (34)	0.141 (61)	0.001 (81)	50
Bahamas, The	98.50	0.429 (25)	0.522 (21)	0.34 (26)	0.001 (80)	11
Bolivia	42.00	0.083 (70)	0.071 (67)	0.075 (69)	0.003 (51)	10
Brazil	38.95	0.455 (24)	0.357 (36)	0.467 (19)	0.002 (55)	104
Chile	81.40	0.622 (10)	0.995 (3)	0.222 (46)	0.31 (12)	24
Colombia	68.90	0.414 (28)	0.545 (19)	0.149 (58)	0.77 (6)	21
Costa Rica	66.25	0.362 (38)	0.417 (27)	0.264 (36)	0.512 (8)	42
Dominican Republic	45.88	0.184 (61)	0.132 (59)	0.228 (45)	0.007 (42)	57
Ecuador	76.19	0.191 (60)	0.175 (56)	0.209 (49)	0 (84)	19
El Salvador	56.15	0.206 (57)	0.182 (55)	0.232 (43)	0 (85)	13
Honduras	81.41	0.143 (63)	0.142 (58)	0.144 (59)	0.009 (39)	15
Jamaica	79.12	0.343 (41)	0.471 (25)	0.229 (44)	0.019 (35)	5
Nicaragua	37.53	0.081 (71)	0.108 (62)	0.055 (71)	0.006 (43)	5
Panama	67.11	0.258 (50)	0.3 (45)	0.216 (47)	0.002 (62)	41
Peru	60.55	0.24 (52)	0.244 (52)	0.238 (40)	0.002 (58)	15
Trinidad and Tobago	72.20	0.345 (40)	0.382 (31)	0.273 (34)	0.002 (57)	9
Venezuela, RB	27.79	0.236 (53)	0.306 (44)	0.15 (57)	0.001 (70)	27

Country	Z-score	Financial inclusion index	Penetration	Availability	Usage	No. of Banks
Average/Total	**61.09**	**0.285**	**0.337**	**0.214**	**0.097**	**468**
Africa						
Algeria	52.52	0.079 (72)	0.127 (60)	0.028 (82)	0.051 (24)	12
Angola	29.28	0.047 (80)	0.04 (70)	0.05 (73)	0.065 (22)	12
Botswana	31.01	0.199 (59)	0.307 (43)	0.086 (68)	0.002 (60)	7
Burundi	22.35	0.051 (79)	0.027 (75)	0.043 (76)	0.387 (10)	5
Cameroon	56.97	0.033 (83)	0.015 (81)	0.047 (75)	0.077 (20)	8
Egypt, Arab Rep.	52.70	0.102 (68)	0.155 (57)	0.05 (74)	0.004 (47)	21
Ghana	41.46	0.059 (76)	0.072 (66)	0.041 (78)	0.019 (36)	17
Kenya	63.71	0.055 (77)	0.072 (65)	0.037 (79)	0.034 (29)	29
Libya	151.23	0.051 (78)	0.053 (69)	0.051 (72)	0.001 (76)	6
Malawi	57.49	**0.027 (85)**	0.028 (73)	0.025 (83)	0.032 (31)	5
Mauritius	59.91	0.557 (13)	0.497 (22)	0.616 (14)	0.036 (28)	12
Mozambique	35.35	0.03 (84)	0.027 (74)	0.034 (80)	0.008 (41)	10
Namibia	108.44	0.231 (55)	0.292 (47)	0.109 (66)	0.003 (52)	6
Rwanda	20.65	0.112 (67)	0.06 (68)	0.151 (56)	0.186 (16)	7
South Africa	43.07	0.182 (62)	0.209 (53)	0.155 (55)	0.006 (44)	14
Tanzania	74.09	0.034 (82)	0.028 (72)	0.02 (85)	0.27 (13)	21
Uganda	35.78	0.044 (81)	0.036 (71)	0.025 (84)	0.341 (11)	14
Zambia	22.05	0.071 (75)	0.018 (79)	0.032 (81)	0.837 (5)	12
Average/Total	**53.23**	**0.109**	**0.115**	**0.089**	**0.131**	**218**

Table 4.3

Correlation matrix of bank- and country-level variables

Panel A: Correlation matrix of bank level variables

		1	2	3	4	5	6	7	8
1	C-Lerner	1							
2	E-Lerner	0.34***	1						
3	Loan Ratio	0.12***	0	1					
4	Bank Size	0.04***	-0.07***	0.02*	1				
5	Loan Loss Provision	0.01	0	-0.05***	-0.03**	1			
6	Income Diversification	0.05***	0.03**	-0.05***	-0.01	0.02*	1		
7	Management Quality	-0.03***	-0.10***	0.21***	0.10***	-0.13***	-0.08***	1	
8	Capitalisation	0.07***	0.09***	-0.06***	-0.37***	0.11***	0.07***	-0.29***	1

Panel B: Correlation matrix of country level variables

		1	2	3	4	5	6	7	8	9	10
1	Findex	1									
2	Voice	0.58***	1								
3	Political Stability	0.57***	0.75***	1							
4	Government effectiveness	0.66***	0.80***	0.80***	1						
5	Regulatory quality	0.60***	0.86***	0.80***	0.92***	1					
6	Rule of law	0.63***	0.84***	0.82***	0.97***	0.94***	1				
7	Control of corruption	0.62***	0.79***	0.80***	0.97***	0.89***	0.97***	1			
8	Institutional Quality	0.65***	0.89***	0.88***	0.97***	0.96***	0.98***	0.96***	1		
9	GDP Growth Rate	-0.43***	-0.41***	-0.36***	-0.33***	-0.42***	-0.35***	-0.29***	-0.38***	1	
10	Per Capita GDP	0.70***	0.77***	0.80***	0.82***	0.85***	0.82***	0.79***	0.86***	-0.51***	1

Note that this table provides information on the correlation between the market power, bank-specific and macroeconomic variables used throughout the paper.

Table 4.4

The effect of financial inclusion on banking stability

The dependent variable is the *Z-score*, reported in columns 1-4, the *negative return Volatility* i.e., standard deviation of return on assets, reported in columns 5-8. Bank competition is proxied by two variants of the Lerner indices i.e., conventional Lerner (*C-Lerner*) and efficiency-adjusted Lerner (*E-Lerner*). *Loan ratio* is measured as loans as a percentage of total assets. *Bank size* is the logarithm of total assets valued in U.S. dollars (millions). *Loan loss provision* ratio is measured as a percentage of total assets, where income diversification is the ratio of non-interest income over total income. *The management quality* is measured as the total earning assets over total assets. *Capitalisation* is the bank total equity to asset ratio. To control for economic development, logarithm of *GDP per capita* is used, and *GDP growth rate* is used to account for condition of business cycle in each country. We employ instrumental variable (IV) technique with a GMM estimator. All regressions include year and bank fixed effects. *Financial Inclusion* is treated as an endogenous variable, and it is instrumented via financial freedom, entry density and financial freedom times entry density. We report heteroskedasticity-autocorrelation robust standard errors (HAC). ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Source: BankScope and WDI. Coverage: 2004-2012.

Variables	ln(Z-score)		-log[sd(ROA)]	
	1	2	3	4
	C-Lerner	E-Lerner	C-Lerner	E-Lerner
Loan Ratio	0.115	0.074	-0.06	-0.09
	[0.230]	[0.232]	[0.219]	[0.221]
Bank Size	0.397***	0.440***	0.420***	0.452***
	[0.080]	[0.080]	[0.076]	[0.076]
Loan Loss Provision	-2.102	-2.032	-2.091	-2.039*
	[1.448]	[1.336]	[1.300]	[1.220]
Income Diversification	0.003	0.004	0.005	0.005
	[0.014]	[0.013]	[0.015]	[0.014]
Management Quality	1.432***	1.474***	1.242***	1.277***
	[0.343]	[0.347]	[0.335]	[0.337]
Capitalisation	4.110***	3.900***	1.264***	1.135***
	[0.495]	[0.496]	[0.433]	[0.435]
C-Lerner (-1)	0.714***		0.527***	
	[0.072]		[0.066]	
E-Lerner (-1)		1.331***		0.929***
		[0.135]		[0.127]
Financial Inclusion	**6.272*** **	**6.518*** **	**6.299*** **	**6.489*** **
	[1.795]	[1.810]	[1.715]	[1.731]
GDP Growth Rate	5.253***	5.269***	5.062***	5.090***
	[0.881]	[0.881]	[0.842]	[0.843]
Per Capita GDP	-2.137***	-2.565***	-2.551***	-2.854***
	[0.702]	[0.721]	[0.676]	[0.696]
Observations	11,499	11,499	11,499	11,499
2nd-stage F-test	41.95***	42.34***	41.58***	40.73***
Under id test: KP LM statistic	80.54***	77.81***	80.54***	77.81***
Hansen J-test (p-value)	5.12 (0.08)	3.33 (0.19)	5.31 (0.07)	3.98 (0.14)
Endogeneity test	31.35***	31.28***	31.49***	31.71***

Table 4.5

Interactive result of financial inclusion and bank competition on stability

The dependent variable is the *Z-score*, reported in columns 1-4, the *negative return Volatility* i.e., standard deviation of return on assets, reported in columns 5-8. Bank competition is proxied by two variants of the Lerner indices i.e., conventional Lerner (*C-Lerner*) and efficiency-adjusted Lerner (*E-Lerner*). *Loan ratio* is measured as loans as a percentage of total assets. *Bank size* is the logarithm of total assets valued in U.S. dollars (millions). *Loan loss provision* ratio is measured as a percentage of total assets, where income diversification is the ratio of non-interest income over total income. *The management quality* is measured as the total earning assets over total assets. *Capitalisation* is the bank total equity to asset ratio. To control for economic development, logarithm of *GDP per capita* is used, and *GDP growth rate* is used to account for condition of business cycle in each country. We employ instrumental variable (IV) technique with a GMM estimator. All regressions include year and bank fixed effects. *Financial Inclusion* and *Financial Inclusion times C-Lerner (E-Lerner)* are treated as endogenous variables, and they are instrumented following Table 4.4. We report heteroskedasticity-autocorrelation robust standard errors (HAC). ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Source: BankScope and WDI. Coverage: 2004-2012.

Variables	ln(Z-score)		-log[sd(ROA)]	
	1	2	3	4
	C-Lerner	E-Lerner	C-Lerner	E-Lerner
Loan Ratio	0.119	0.058	-0.055	-0.101
	[0.231]	[0.232]	[0.220]	[0.221]
Bank Size	0.404***	0.441***	0.428***	0.453***
	[0.081]	[0.080]	[0.077]	[0.076]
Loan Loss Provision	-2.104	-2.051	-2.095	-2.053*
	[1.451]	[1.336]	[1.303]	[1.220]
Income Diversification	0.003	0.004	0.005	0.005
	[0.014]	[0.013]	[0.015]	[0.014]
Management Quality	1.460***	1.480***	1.271***	1.282***
	[0.343]	[0.348]	[0.335]	[0.338]
Capitalisation	4.146***	3.880***	1.302***	1.120**
	[0.497]	[0.497]	[0.435]	[0.436]
C-Lerner (-1)	0.334		0.089	
	[0.209]		[0.186]	
E-Lerner (-1)		1.135***		0.786***
		[0.153]		[0.142]
Financial Inclusion	6.418***	6.552***	6.454***	6.519***
	[1.787]	[1.813]	[1.709]	[1.733]
Financial Inclusion X C-Lerner	0.543**		0.626***	
	[0.258]		[0.233]	
Financial Inclusion X E-Lerner		0.410***		0.298**
		[0.139]		[0.117]
GDP Growth Rate	5.367***	5.315***	5.190***	5.127***
	[0.871]	[0.880]	[0.834]	[0.842]
Per Capita GDP	-2.257***	-2.649***	-2.685***	-2.917***
	[0.689]	[0.719]	[0.664]	[0.694]
Observations	11,499	11,499	11,499	11,499
2nd-stage F-test	41.63***	40.72***	41.15***	39.03***
Under id test: KP LM statistic	80.82***	77.44***	80.82***	77.44***
Hansen J-test (p-value)	5.44 (0.07)	3.59 (0.17)	5.68 (0.06)	4.19 (0.12)
AR chi-squared test	28.28***	25.54***	30.75***	28.18***
Endogeneity test	33.74***	32.02***	34.04***	32.35***

Table 4.6

The impact of financial inclusion and institutional quality interactions on banking stability

This table reports IV-GMM regressions of banking stability (i.e., ln(Zscore)) on financial inclusion, six measures of institutional quality and their interactions. The analogous bank and macro controls are used as in equation (4.1). We use lagged values of efficiency adjusted Lerner index as the proxy for market power. Each interaction and its constituents are entered one at a time. For the sake of brevity, the results of the controls are not reported in this table but available upon request. Financial inclusion and financial inclusion times each institutional quality variable are treated as endogenous variables. The variables that are used as instruments are reported at the bottom of this table. The institutional variables are collected from the Kaufmann et al. (2010) dataset. The variable Voice and accountability (Voice) measures the degree of freedom of expressions and free media in a country. Political stability (Political) captures the perception of probability that the government is destabilized or overthrown by nonviolent or non-constitutional means. The variable Government effectiveness (Government) measures the quality in formulation and implementation and the commitment of the government with related policies. The regulatory quality (Regulatory) indicates the perception ability of a government to formulate and to implement political regulations that allow promoting development of the private sector. The variable rule of law (Law) measures the perception of agents about its confidence in the existing norms and the degree in which they can rely that the contracts will be fulfilled and the property rights will be protect by the courts. The variable control of corruption (Corruption) indicates the perception on magnitude in which the public power is exerted to obtain private gain. These six indicators are measured in units ranging from about -2.5 to 2.5, with higher values corresponding to better governance and institutional quality. In column 7, we capture common variation among these six governance indicators using the principal component analysis and construct a composite index of institutional quality (IQI).

Variables	log(Zscore 1	log(Zscore 2	log(Zscore 3	log(Zscore 4	log(Zscore 5	log(Zscore 6	log(Zscore 7
Financial inclusion index (FII)	3.426***	8.197***	5.298***	1.277	5.804***	6.216***	10.878***
	[1.275]	[2.413]	[1.580]	[2.213]	[1.714]	[1.947]	[2.977]
Voice and accountability (Voice)	-2.135*						
	[1.162]						
FII x Voice	7.391***						
	[2.105]						
Political stability (Political)		-2.228**					
		[1.127]					
FII x Political		5.946**					
		[2.677]					
Government effectiveness (Government)			0.744				
			[1.402]				
FII x Government			-2.697				
			[3.161]				
Regulatory quality (Regulatory)				-10.640**			
				[5.118]			
FII x Regulatory				21.321**			
				[10.272]			
Rule of law (Law)					-2.792***		
					[0.980]		
FII x Law					5.983**		
					[3.008]		
Control of corruption (Corruption)						0.639	
						[0.862]	
FII x Corruption						0.207	
						[1.436]	
Institutional quality index (IQI)							-0.606
							[0.477]
FII x IQI							2.347**
							[1.139]
Observations	11,450	11,499	11,499	11,499	11,499	11,499	11,499
Bank and Macro controls	√	√	√	√	√	√	√
Bank and year fixed effects	√	√	√	√	√	√	√
2nd-stage F-test	42.66***	36.51***	40.37***	26.08***	38.85***	42.58***	39.56***
Under id test: KP LM statistic	54.32***	46.39***	63.11***	9.28***	74.99***	85.81***	71.97***
Hansen J-test (p-value)	1.19 (0.28)	0.02 (0.90)	4.57 (0.10)	0.62 (0.43)	1.07 (0.30)	4.72 (0.09)	1.62 (0.44)
AR chi-squared test	29.05***	21.32***	24.04***	25.25***	24.72***	27.75***	26.75***
Endogeneity test	29.04***	31.18***	21.47***	31.67***	20.77***	23.82***	38.23***
Instruments							
Financial freedom	√	√	√	√	√	√	√
Labour freedom		√	√	√		√	√
Entry density	√		√	√	√	√	√
Entry density * Financial freedom			√		√	√	
Entry density * Labour freedom							√
Credit information depth	√						
Marginal effect	8.42***	10.13***	2.97	16.46**	9.44***	6.34*	10.88***
One standard deviation above average ↑	13.61***	14.95***	0.01	32.01***	14.88***	6.54**	16.29***

Table 4.7

The effect of Global financial inclusion (GFI) on banking stability

In this table we use Global Financial Inclusion Index (Global Findex) based on World Bank. Since this measure is only available for the year 2011, we had to collapse our dataset at bank-level to run cross-sectional regression. Initially we conduct endogeneity test for the Global financial inclusion index, which is reported at the bottom of the table. In case of rejecting the null hypothesis of exogeneity, we employ the instrumental variable (IV) estimator; otherwise we use the ordinary least squares (OLS) estimator with robust standard error. When we added interaction with GFI (e.g., columns 3, 4, 7 and 8), we treated both GFI and its interaction as endogenous variables. We used financial freedom, entry density and their interactions as instruments. The underidentification (UT) and over identification (OT) tests are reported by the Anderson canonical correlations LM statistic and Sargan's *J-test*, respectively to show the relevance and validity of the instruments used for the Global financial inclusion index. The definitions of the rest of the variables are the same as Table 4.4. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Source: BankScope and World Bank.

	log(Zscore)				**-log[sd(ROA)]**			
Variables	1	2	3	4	5	6	7	8
	C-Lerner	E-	C-	E-Lerner	C-	E-	C-	E-Lerner
Loan Ratio	0.310*	0.188	-0.009	0.364	0.019	0.115	-0.036	0.776*
	[0.182]	[0.131]	[0.129]	[0.275]	[0.123]	[0.124]	[0.123]	[0.407]
Bank Size	0.030**	0.047**	0.038**	0.122**	0.064**	0.071**	0.063**	0.146**
	[0.012]	[0.011]	[0.011]	[0.055]	[0.010]	[0.010]	[0.010]	[0.045]
Loan Loss Provision	-	-6.510*	-6.375*	-	-	-6.463*	-	-
	[0.605]	[3.454]	[3.281]	[1.379]	[3.163]	[3.315]	[3.131]	[1.383]
Income Diversification	-0.016	0.01	-0.067	0.034	-0.07	-0.027	-0.094	0.027
	[0.058]	[0.065]	[0.054]	[0.104]	[0.066]	[0.061]	[0.063]	[0.112]
Management Quality	2.121**	2.288**	2.051**	1.508*	2.320**	2.355**	2.204**	1.056
	[0.303]	[0.326]	[0.306]	[0.830]	[0.297]	[0.305]	[0.292]	[0.833]
Capitalisation	2.605**	2.067**	2.104**	3.250**	-	-	-	-1.198
	[0.318]	[0.313]	[0.309]	[0.905]	[0.273]	[0.275]	[0.276]	[0.914]
C-Lerner	0.980**		0.337**		0.615**		0.240*	
	[0.103]		[0.146]		[0.077]		[0.131]	
E-Lerner		0.356**		-4.307		0.06		-4.776*
		[0.101]		[3.177]		[0.092]		[2.537]
Global financial inclusion	**0.018****	**0.001**	**0.005****	**0.009**	**0.012****	**0.010****	**0.014****	**0.040****
	[0.007]	**[0.002]**	**[0.002]**	**[0.008]**	**[0.002]**	**[0.002]**	**[0.002]**	**[0.016]**
GFI x C-Lerner			**1.443****				**1.086****	
			[0.313]				**[0.289]**	
GFI x E-Lerner				**7.501**				**8.146***
				[5.113]				**[4.166]**
GDP Growth Rate	-	-	-	1.283	-	-	-	-2.618
	[1.719]	[0.999]	[0.976]	[3.794]	[0.929]	[0.942]	[0.929]	[3.706]
Per Capita GDP	-0.181**	0.013	-0.025	0.02	-0.014	0.007	-0.028	-0.204
	[0.080]	[0.027]	[0.027]	[0.077]	[0.026]	[0.026]	[0.026]	[0.162]
Constant	2.396**	0.802**	1.447**	0.715	3.630**	3.374**	3.877**	4.953**
	[0.675]	[0.392]	[0.384]	[0.734]	[0.357]	[0.365]	[0.362]	[1.327]
Observations	2,238	2,497	2,497	2,238	2,497	2,497	2,497	2,238
Estimator	IV	OLS	OLS	IV	OLS	OLS	OLS	IV
F-statistics	45.80	24.69	36.37	10.06	123.10	114.90	112.80	27.23
Adjusted R2	-	0.14	0.19	-	0.39	0.37	0.39	-
UT: Anderson canon. corr. LM	137.60	-	-	2.70	-	-	-	4.53
OT (Sargan) (p-value)	2.14	-	-	1.10	-	-	-	3.05
Endogeneity test	0.04	0.10	0.43	0.04	0.07	0.21	0.23	0.01

Table 4.8

The effect of Financial Inclusion on bank stability (Alternative Measure)

In this table, following Beck et al. (2013), we use an alternative measure of bank stability in which the denominator in equation (4.2) is calculated using five year rolling windows. *Financial Inclusion* and *Financial Inclusion times C-Lerner (E-Lerner)* are treated as endogenous variables, and they are instrumented following Table 4.4. The underidentification (UT) and over identification (OT) tests are reported by the Kleibergen and Paap (2006) test for weak instruments and Hansen *J-test*, respectively to show the relevance and validity of the instruments used. The Anderson-Rubin Chi2 test shows that *Financial Inclusion* and *Financial Inclusion times C-Lerner (E-Lerner)* are jointly significant. The definitions of the rest of the variables are the same as Table 4.4. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Source: BankScope and World Bank.

Variables	log(Zscore5)				-log[sd5(ROA)]			
	1	2	3	4	5	6	7	8
	C-Lerner	E-Lerner	C-Lerner	E-Lerner	C-Lerner	E-Lerner	C-Lerner	E-Lerner
Loan Ratio	0.17	0.109	0.166	0.106	-0.012	-0.058	-0.012	-0.06
	[0.215]	[0.214]	[0.216]	[0.214]	[0.208]	[0.208]	[0.208]	[0.208]
Bank Size	0.338***	0.357***	0.336***	0.361***	0.314***	0.330***	0.314***	0.333***
	[0.075]	[0.075]	[0.076]	[0.075]	[0.071]	[0.071]	[0.071]	[0.072]
Loan Loss Provision	-2.518***	-2.413***	-2.516***	-2.420***	-2.367***	-2.272***	-2.366***	-2.279***
	[0.842]	[0.805]	[0.842]	[0.807]	[0.748]	[0.719]	[0.748]	[0.721]
Income Diversification	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002
	[0.007]	[0.007]	[0.007]	[0.007]	[0.008]	[0.007]	[0.008]	[0.007]
Management Quality	1.186***	1.199***	1.192***	1.198***	0.934***	0.945***	0.942***	0.944***
	[0.339]	[0.335]	[0.337]	[0.336]	[0.318]	[0.314]	[0.316]	[0.315]
Capitalisation	2.691***	2.463***	2.689***	2.457***	1.033**	0.870**	1.037**	0.865**
	[0.452]	[0.448]	[0.450]	[0.449]	[0.409]	[0.412]	[0.408]	[0.413]
C-Lerner	0.488***		0.541***		0.401***		0.366**	
	[0.062]		[0.202]		[0.055]		[0.181]	
E-Lerner		1.099***		0.956***		0.832***		0.713***
		[0.124]		[0.144]		[0.119]		[0.138]
Financial Inclusion	6.688***	7.032***	6.724***	7.016***	6.628***	6.883***	6.671***	6.873***
	[1.811]	[1.812]	[1.802]	[1.816]	[1.711]	[1.718]	[1.704]	[1.721]
Financial Inclusion X C-Lerner			-0.071				0.05	
			[0.237]				[0.212]	
Financial Inclusion X E-Lerner				0.278**				0.231*
				[0.133]				[0.127]
GDP Growth Rate	4.414***	4.518***	4.423***	4.539***	4.315***	4.402***	4.340***	4.421***
	[0.891]	[0.889]	[0.879]	[0.890]	[0.855]	[0.857]	[0.845]	[0.858]
Per Capita GDP	-2.125***	-2.524***	-2.132***	-2.562***	-2.404***	-2.697***	-2.431***	-2.729***
	[0.806]	[0.818]	[0.790]	[0.818]	[0.779]	[0.794]	[0.766]	[0.794]
Observations	9,338	9,338	9,338	9,338	9,338	9,338	9,338	9,338
2nd-stage F-test	16.01***	16.86***	15.52***	16.11***	15.71***	14.95***	15.47***	14.24***
Under id test: KP LM statistic	58.79***	57.42***	58.78***	57.20***	58.79***	57.42***	58.78***	57.20***
AR chi-squared test	35.49***	35.13***	35.65***	35.32***	37.26***	36.73***	37.62***	36.96***
Hansen J-test	4.39 (0.11)	3.37 (0.19)	4.37 (0.11)	3.43 (0.18)	4.17 (0.12)	3.32 (0.19)	4.20 (0.12)	3.40 (0.18)
Endogeneity test	34.11***	35.02***	34.52***	35.19***	31.99***	32.75***	32.47***	32.89***

Table 4.9

Financial inclusion and banking stability: robustness checks

	Tercile 1: the lowest financial inclusion		**Tercile 2: medium financial inclusion**		**Tercile 3: the highest financial inclusion**		**Commercial banks: Cooperative and Islamic banks excluded**		**Rest of the sample: Japan and Italy excluded**		**Only Developing Countries: Developed Countries excluded**	
	1	2	3	4	5	6	7	8	9	10	11	12
Variables	log(Zscore	-	log(Zscore	-	log(Zscore	-	log(Zscore	-	log(Zscore	-	log(Zscore	-
Loan Ratio	0.591*	0.341	0.282	0.063	1.626***	1.760***	0.462*	0.27	0.339	0.176	0.376	0.113
	[0.309]	[0.308]	[0.372]	[0.355]	[0.483]	[0.471]	[0.260]	[0.249]	[0.249]	[0.237]	[0.315]	[0.293]
Bank Size	0.715***	0.660***	0.381***	0.453***	0.678***	0.613***	-0.001	0.049	0.103	0.143	-0.075	-0.037
	[0.140]	[0.131]	[0.138]	[0.133]	[0.202]	[0.192]	[0.102]	[0.097]	[0.093]	[0.088]	[0.137]	[0.129]
Loan Loss Provision	-3.722***	-3.286***	-5.561***	-4.944***	-0.366	-0.591	-1.181	-1.237	-1.328	-1.355	-3.770***	-3.451***
	[0.926]	[0.951]	[1.344]	[1.228]	[0.916]	[0.894]	[1.036]	[0.927]	[1.070]	[0.950]	[0.944]	[0.898]
Income Diversification	0.191	0.173	0.129	0.159	-0.002	-0.001	0.236*	0.228**	0.046	0.071	0.486**	0.461**
	[0.176]	[0.163]	[0.146]	[0.129]	[0.009]	[0.010]	[0.126]	[0.109]	[0.069]	[0.057]	[0.224]	[0.190]
Management Quality	0.337	0.255	1.942***	1.535**	0.791	0.355	1.346***	1.111***	1.502***	1.243***	1.864***	1.700***
	[0.424]	[0.412]	[0.744]	[0.754]	[1.018]	[0.898]	[0.406]	[0.393]	[0.392]	[0.378]	[0.542]	[0.518]
Capitalisation	2.525***	-0.064	3.883***	1.233*	7.493***	3.961***	1.469***	-1.000**	2.067***	-0.481	1.652***	-0.806*
	[0.701]	[0.635]	[0.789]	[0.726]	[1.859]	[1.507]	[0.444]	[0.407]	[0.437]	[0.396]	[0.527]	[0.478]
E-Lerner	0.196	-0.12	0.31	0.028	2.605***	1.931***	1.162***	0.790***	1.052***	0.689***	1.079***	0.738***
	[0.219]	[0.208]	[0.213]	[0.196]	[0.320]	[0.290]	[0.177]	[0.168]	[0.164]	[0.155]	[0.236]	[0.226]
Financial Inclusion	**-11.597****	**-10.137****	**13.601*****	**12.266*****	**26.586*****	**24.286*****	**8.081*****	**7.833*****	**7.998*****	**7.697*****	**6.386*****	**6.381*****
	[4.724]	**[4.471]**	**[4.720]**	**[4.399]**	**[8.511]**	**[8.019]**	**[2.241]**	**[2.119]**	**[2.166]**	**[2.045]**	**[2.227]**	**[2.110]**
GDP Growth Rate	-1.237	-0.942	2.066	1.654	2.688	3.104	5.634***	5.464***	6.033***	5.830***	3.831***	3.683***
	[1.246]	[1.204]	[1.413]	[1.316]	[2.448]	[2.305]	[0.906]	[0.854]	[0.810]	[0.764]	[0.927]	[0.880]
Per Capita GDP	4.154***	3.613***	-5.649***	-5.542***	-7.808	-7.285	-2.222**	-2.287***	-2.677***	-2.654***	-1.454*	-1.544*
	[1.387]	[1.339]	[2.065]	[1.914]	[5.156]	[4.925]	[0.866]	[0.825]	[0.874]	[0.831]	[0.838]	[0.802]
Observations	3,223	3,223	4,123	4,123	3,938	3,938	5,516	5,516	6,390	6,390	3,439	3,439
Number of banks	733	733	995	995	678	678	1,117	1,117	1,283	1,283	708	708
2nd-stage F-test	10.54***	9.03***	14.76***	17.69***	33.53***	31.13***	17.56***	15.96***	20.0***	18.02***	12.13***	11.5***
Under id test: KP LM	35.69***	35.69***	24.14***	24.14***	40.69***	40.69***	41.32***	41.32***	44.4***	44.4***	29.2***	29.2***
Hansen J-test	0.21	0.21 (0.90)	0.84	2.23 (0.14)	0.23	1.37 (0.24)	0.38	0.75 (0.39)	0.89	1.17 (0.28)	0.81	1.34 (0.25)
Endogeneity test	4.71***	3.87***	18.73***	18.67***	5.11***	3.76***	29.14***	27.63***	28.85***	26.97***	19.27***	19.61***

This table reports robustness tests of financial inclusion and banking stability. We use as usual IV-GMM estimators. In the first six columns, we split the sample into three terciles based on financial inclusion and re-run regressions. In this case we use investment freedom, entry density and investment freedom times entry density as instruments. The validity of the instruments is confirmed by the under-identification and over-identification tests reported at the bottom of the table. In columns 7 and 8, we dropped observations of the cooperative and Islamic banks keeping only commercial banks. In the last two columns, we dropped observations of Japan and Italy as they comprise the lion share of our sample and re-run regressions. For the specification of 7, 8, 9 and 10, we use financial freedom and entry density as the instruments. The results of the first-stage regressions are available from the author upon request. The analogous bank and macro controls are used as in equation (4.1). We use lagged values of efficiency adjusted Lerner index as the proxy for market power.

Table 4.10

The causal effects of enabling inclusive financial environment on banking stability

Panel A of Table 4.10 reports the results of difference-in-differences (DID) regression estimation on a matched sample. In all specifications, year dummies are included to control for the business cycle. Standard errors are clustered at the country-level as omitted country characteristics might cause error terms to be correlated for banks within the same country. While we control for country fixed effects in columns 1-4, we consider bank fixed effects in columns 5-8. Panel B of Table 4.10 reports the results of the matching estimators. we use two other matching techniques (i.e., kernel and stratification) and recently developed covariate matching estimator of Abadie and Imbens (2006)) to estimate the average treatment effect for the treated (ATT). In all matching estimators, we impose common support condition to restrict control groups to fall within the support of the propensity score distribution of the treated groups. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Source: BankScope and World Bank.

Panel A: DID	**log(Zscore)**		**-log(sd(ROA)**		**log(Zscore)**		**-log(sd(ROA)**	
Variables	1	2	3	4	5	6	7	8
AFI	0.314**	0.270*	0.385**	0.274**	0.341**	0.311**	0.310*	0.254
	[0.123]	[0.136]	[0.124]	[0.135]	[0.152]	[0.148]	[0.157]	[0.161]
Loan Ratio		0.793***		0.580**		0.632		0.402
		[0.243]		[0.226]		[0.566]		[0.625]
Bank Size		0.066**		0.122**		0.289		0.269
		[0.029]		[0.022]		[0.188]		[0.171]
Loan Loss Provision		-7.652***		-		-		-
		[1.328]		[1.045]		[1.273]		[1.324]
Income Diversification		-0.114		-0.453		0.207		0.192
		[0.345]		[0.296]		[0.498]		[0.522]
Management Quality		0.232		0.289		0.019		0.157
		[0.369]		[0.342]		[0.769]		[0.766]
Capitalisation		1.836***		-		1.535		-1.255
		[0.515]		[0.433]		[1.326]		[1.306]
E-Lerner		0.107		-0.334		0.156		-0.165
		[0.263]		[0.218]		[0.342]		[0.331]
GDP Growth Rate		0.283		-0.182		0.19		0.117
		[1.465]		[1.349]		[1.208]		[1.260]
Per Capita GDP		0.83		1.109		1.633		1.462
		[1.123]		[1.142]		[1.246]		[1.333]
Constant	3.381***	-4.184	5.368**	-3.916	3.379***	-11.792	5.443**	-7.799
	[0.114]	[8.554]	[0.108]	[8.698]	[0.132]	[9.368]	[0.124]	[10.095
Observations	2,071	2,027	2,071	2,027	2,071	2,027	2,071	2,027
Bank fixed effects	No	No	No	No	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	No	No	No	No
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R2	0.16	0.23	0.23	0.36	0.61	0.63	0.64	0.65
F-statistics	5.32	14.71	4.16	24.04	4.80	3.67	2.57	2.44

Panel B: Matching estimator	**Kernel**		**Stratified**		**Abadie-Imbens**	
Treatment effects	**Log (Zscore)**	**-log (sd(ROA)**	**Log (Zscore)**	**-log (sd(ROA)**	**Log (Zscore)**	**-log (sd(ROA)**
	1	2	3	4	5	6
ATT	0.109**	0.088**	0.114***	0.081*	0.889***	1.267***
S.E.	[0.045]	[0.041]	[0.039]	[0.043]	[0.308]	[0.252]
t-stat	[2.430]	[2.164]	[2.952]	[1.871]	[2.886]	[5.028]
Observations	13,836	13,836	13,836	13,836	13,524	13,524
Common support condition	Yes	Yes	Yes	Yes	Yes	Yes

Appendix 4.A
Principal Component analysis

Using individual dimension in an equation may provide an incomprehensive picture of financial inclusion. In addition, modelling various dimensions of financial inclusion in the same equation would lead to multicollinearity. We use principal component analysis (PCA) to combine these dimensions and create an index of financial inclusion. Using PCA to construct indices is well-documented in several papers (see Ellul and Yerramilli, 2013; Bali, Brown and Caglayan, 2014). It is a multivariate statistical technique used to reduce a large number of variables in a data set into a smaller number of 'dimensions' (i.e., principal components) by parsing any redundancies among the original variables while retaining most of the variance in the original variables.[95] In mathematical terms, from an initial set of n correlated variables, PCA generates uncorrelated principal components (PC_i), where each component is a linear weighted combination of the original variables and components themselves are orthogonal to each other. It can be shown as:

$$\begin{aligned} PC_1 &= w_{11}X_1 + w_{12}\mathrm{X}_2 + \cdots + \mathrm{w}_{1n}X_n \\ &\vdots \\ PC_m &= w_{m1}X_1 + w_{m2}\mathrm{X}_2 + \cdots + \mathrm{w}_{mn}X_n \end{aligned} \tag{4.A1}$$

which can be re-written as

$$PC = \sum_{i=1}^{n} w_{ij}X_i \quad for\ (j = 1,2,\cdots m) \tag{4.A2}$$

where $P = [P_1, P_2, \ldots, P_m]$ are the principal components; $W = [w_{ij}]\ for\ i = (1,2,\ldots,m)$ and $j = (1,2,\ldots,n)$ are component loadings or weights; and $X = [\mathrm{X}_1, X_2, \ldots, X_n]$ are the original variables. The eigenvectors of the correlation matrix are proportional to the weights of each principal component, and it reflects the variance contribution of principal components to original variables. The eigenvalue of the analogous eigenvector is the variance for each principal component. The components are ranked, and they are extracted in decreasing order of importance so that the first component (PC_1) explains the largest possible amount of variations in the original data conditional to the constraint that the sum of the squared weights $(w_{11}^2 + w_{12}^2 + \cdots + w_{1n}^2)$ is equal to one. The second component (PC_2) is entirely uncorrelated with the first component and explains the second largest variations, less than the first component, subject to the same constraint. The subsequent components are independent of the previous components and explain smaller and smaller proportions of the variation of the original data. The greater correlation among original variables necessitates fewer principal components to capture common information.

It is noted that principal component can be extracted by using original variables or by their deviations from their averages, or by the standardized variables.[96] As the indicators of financial inclusion are measured in different units, we deem to follow the latter approach in this study. We use the following equation to construct the composite index of financial inclusion (FII):

$$FII = \sum_{i=1}^{n} w_{ij}X_i \tag{4.A3}$$

[95] See Jolliffe (2002) for a detailed discussion on PCA.

[96] We used standardized variables with mean of zero and standard deviation of one instead of min-max normalisation and construct financial inclusion index. These two indices are perfectly correlated, indicating the robustness of our index.

Table 4.A1

Principal component analysis for financial inclusion index

Panel A	Notation	PC1	PC2	PC3	PC4
Eigenvalue		2.81	0.69	0.45	0.05
% of variance		0.70	0.17	0.11	0.01
Variable					
Geographic penetration of Branches	AGB	0.52	-0.46	-0.38	-0.61
Geographic penetration of ATMs	AGA	0.52	-0.50	0.34	0.61
Demographic penetration of Branches	ADB	0.47	0.55	-0.59	0.36
Demographic penetration of ATMs	ADA	0.48	0.50	0.63	-0.35
Panel B		PC1	PC2	PC3	
Eigenvalue		1.54	0.99	0.46	
% of variance		0.51	0.33	0.15	
Variable					
Accessibility/Penetration Dimension	Penetration	0.71	-0.02	-0.71	
Availability Dimension	Availability	0.71	-0.06	0.71	
Usage Dimension	Usage	0.06	1.00	0.03	

Note: AGB = the number of branches per 1,000 km2; AGA = the number of ATMs per 1,000 km2; ADB = the number of branches per 100,000 adults; ADA = the number of ATMs per 100,000 adults; Penetration = the number of deposit and loan accounts per 1000 adults; Availability = The Outreach Dimension; Usage = Total volume of deposit and loans relative to GDP.

Table 4.A2

Inclusive financial system and firm financing obstacle or access to finance, firm level results

We run ordered probit model when *Financing Obstacle* is the dependent variable and logit model for the case of *Access to Finance*. In both cases, robust standard errors are reported in brackets. Both dependent variables are constructed using the World Bank Enterprise Surveys. In the case of the former, firms were asked to rate on a five point scale how much of an obstacle access to finance is for the operation and growth of the business: (0) No obstacle (1) minor obstacle (2) moderate obstacle (3) major obstacle (4) very severe obstacle. For the latter case, *Access to Finance* is a dummy variable that indicates whether the firm has access to a loan, overdraft, or a line of credit. The *firm size* is the logarithm of the firms' total number of permanent employees. The dummy variable *Exporter* indicates that firms are involved in exporting. The *Manufacturing* dummy indicates that a firm is in the manufacturing sector. *Government-owned* and *Foreign-owned* are dummies that are equal to one if the firm has government or foreign ownership, respectively. Log *firm age* is the logarithm of the firm's age in years. *GDP growth rate* is the annual growth rate in percentage. Regional dummies are Sub-Sahara Africa, Asia and Pacific, Europe, Americas, and South Asia, with the Middle East and North Africa being the omitted category. . ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Source: World Bank Enterprise Surveys and WDI. Coverage: 2004-2012.

	Financing Obstacle		**Access to Finance**	
VARIABLES	Coef	se	coef	se
Financial Inclusion	-0.361***	[0.040]	2.570***	[0.088]
Log firm size (employees)	-0.046***	[0.004]	0.174***	[0.009]
Exporter	-0.024*	[0.015]	0.594***	[0.031]
Manufacturing	0.143***	[0.012]	-0.193***	[0.025]
Foreign-owned (>=50% shares)	-0.250***	[0.020]	-0.199***	[0.041]
Government-owned (>=10% shares)	-0.065*	[0.037]	-0.894***	[0.076]
Log Firm Age	-0.079***	[0.011]	0.370***	[0.022]
GDP growth rate	0.002*	[0.001]	-0.066***	[0.003]
Sub-Sahara Africa	0.374***	[0.057]	0.512***	[0.120]
Asia and Pacific	-0.371***	[0.057]	0.337***	[0.121]
Europe	0.268***	[0.059]	-0.245**	[0.125]
Americas	0.199***	[0.057]	1.109***	[0.121]
South Asia	0.230***	[0.067]	0.560***	[0.139]
Observations	38,987		38,987	
No of countries	64		64	
Pseudo R-squared	0.02		0.11	

Appendix 4.B

Estimating marginal cost using a translog cost function

The input and output choices are specified according to the intermediation approach of Sealey and Lindley (1977). Following Koetter, Kolari and Spierdijk (2012), a production technology is specified with three inputs (i.e., labour, capital and borrowed funds) and one output (i.e., total assets). Since the information on the prices of loans and deposits are limited, we use total assets as an aggregate measure of banking activity, as previously used by Berger, Klapper and Turk-Ariss (2009) and Beck, De Jonghe and Schepens (2013). We include equity in the production function to account for various risk attitudes of banks. The following translog total cost function is specified for bank $i = 1,...,N$ at time $t = 1,...,T$ as:

$$\ln TOC_{it} = \beta_0 + \sum_{j=1}^{3}\beta_j \ln \mathrm{W}_{j,it} + \gamma_1 \ln \mathrm{Q}_{it} + \delta \ln \mathrm{Z}_{it} + \sum_{j=1}^{3}\left(\frac{\varsigma_j}{2}\right)\ln \mathrm{W}_{j,it}^2 + \sum_{j}^{3}\sum_{k}^{3}\eta_{jk}\ln W_{j,it}\ln W_{k,it}$$
$$+\left(\frac{\theta}{2}\right)\ln \mathrm{Q}_{it}^2 + \sum_{j=1}^{3}\lambda_j \ln W_{j,it}\ln Q_{it} + \sum_{k=1}^{2}\rho_k trend^k + \sum_{j=1}^{3}\varepsilon_j \ln W_{j,it} trend + \omega_1 \ln \mathrm{Q}_{it}\, trend + \varepsilon_{it} \quad (4.B1)$$

where TOC_{it} is the total costs including financial and operating cost; Q_{it} represents one output i.e., total assets, and $w_{j,it}$ ($j = 1,2,3$) are input prices where w_1 is the price of funds; w_2 is the price of labour; w_3 is the price of capital of bank i at time t; z_{it} is total equity of bank i at time t; and *trend* is the time trend to capture technical change. We impose homogeneity of degree one on input prices and divided all factor prices and TOC_{it} by w_3. The marginal cost is measured by taking the first derivative with respect to output for each bank in the sample after estimating cost function as:

$$\mathrm{MC}_{it} = \frac{TOC_{it}}{Q_{it}}\left[\gamma_1 + \theta_1 \ln \mathrm{Q}_{it} + \sum_{j=1}^{3}\lambda_{1j}\ln W_{j,it} + \omega_1 trend\right] \quad (4.B2)$$

The shortcoming of the conventional Lerner index estimated above is that it is measured assuming full bank efficiency and therefore it fails to account for the possibilities of banker inability to exploit output pricing opportunities resulting from market power. Following Koetter, Kolari and Spierdijk (2012), we estimate efficiency-adjusted Lerner indices from a single structural model as:

$$(\widehat{AR_{it}} - MC_{it}) / \widehat{AR_{it}} \quad (4.B3)$$

where $\widehat{AR_{it}}$ is the average revenue computed as $\widehat{TR} / TA$, where, $TR = \widehat{PBT} + \widehat{TOC}$. In order to obtain efficiency-adjusted Lerner indices we have to estimate expected profit $\widehat{PBT}$ from an alternative profit function[97] and expected total costs $\widehat{TOC}$ from equation (4.B1). Dissimilar to conventional Lerner indices in equation (4.6), the estimation of efficiency-adjusted Lerner accounts for both bank efficiency and degree of market power simultaneously.

[97] To estimate expected profits ($\widehat{PBT}$) we use PBT (i.e. profit before tax) instead of TOC in equation (4.B1) as the dependent variable. Following Bos and Koetter (2011), to account for individual bank losses, we use a negative profit indicator (NPI) in the profit function as many banks in our sample period incurred losses.

Table 4.B1

Descriptive statistics of the variables included in the cost and profit functions.

Source: BankScope

Region	Cost	Profit	Assets	w1	w2	w3	Equity	
Asia	8.9	7.1	7.6	-5.0	-4.7	-5.0	5.0	Mean
	8.8	6.9	7.6	-5.5	-4.8	-5.2	4.8	Median
	1.9	2.3	1.7	1.7	0.6	0.7	1.7	SD
	2.9	-2.6	2.6	-7.6	-8.1	-7.7	0.9	Min.
	14.4	13.6	12.6	-1.6	-1.4	-0.9	9.7	Max.
Europe	8.3	6.3	6.8	-3.8	-4.5	-4.6	4.5	Mean
	7.8	5.9	6.4	-3.7	-4.4	-4.7	4.2	Median
	2.2	2.3	2.0	0.7	0.7	0.8	1.8	SD
	2.7	-2.2	2.6	-7.6	-11.6	-9.5	0.9	Min.
	17.4	14.8	12.6	-1.6	-1.2	0.8	9.7	Max.
Americas	7.6	5.8	6.3	-3.0	-3.9	-3.7	4.3	Mean
	7.6	5.9	6.3	-3.0	-3.8	-3.7	4.2	Median
	2.1	2.5	2.0	0.8	0.8	0.9	1.8	SD
	3.0	-3.0	2.6	-7.3	-8.8	-8.3	0.9	Min.
	14.5	13.2	12.6	-1.6	-0.8	-0.5	9.7	Max.
Africa	7.4	6.1	6.2	-3.5	-4.0	-3.9	4.0	Mean
	7.2	6.1	6.1	-3.3	-3.9	-3.7	3.9	Median
	2.0	2.4	1.7	0.9	0.8	0.9	1.6	SD
	2.9	-2.0	2.6	-7.6	-8.5	-8.4	0.9	Min.
	14.1	13.4	11.8	-1.6	-1.9	-1.4	9.0	Max.
Total	8.4	6.5	7.0	-4.0	-4.5	-4.5	4.6	Mean
	8.1	6.3	6.8	-3.7	-4.5	-4.7	4.4	Median
	2.1	2.4	1.9	1.4	0.8	0.9	1.8	SD
	2.7	-3.0	2.6	-7.6	-11.6	-9.5	0.9	Min.
	17.4	14.8	12.6	-1.6	-0.8	0.8	9.7	Max.

The dataset comprises 2913 banks in 87 countries.
Note: All variables are in logarithmic format.

Appendix 4.C

Table 4.C1

First-stage regression: Financial inclusion

Variables	Dependent variable: Financial inclusion			
	1	2	3	4
Financial freedom	0.0017***	0.0018***	0.0020***	0.0020***
	[6.62]	[6.74]	[6.98]	[7.00]
Entry density	0.0035***	0.0034***	0.0079***	0.0074***
	[6.92]	[6.77]	[5.80]	[5.51]
Financial freedom x Entry density			-0.0001***	-0.0001***
			[-3.39]	[-3.13]
C-Lerner	-0.0080**		-0.0083***	
	[-2.55]		[-2.64]	
E-Lerner		-0.0348***		-0.0343***
		[-5.42]		[-5.37]
Observations	11,499	11,499	11,499	11,499
Bank and Macro controls	Yes	Yes	Yes	Yes
Bank and Year fixed effect	Yes	Yes	Yes	Yes
R-squared	0.36	0.36	0.36	0.36
F-statistics	86.42	86.73	82.21	82.72

Notes: This table reports regressions of financial inclusion on financial freedom, entry density and financial freedom times entry density. In order to make our identification strategy as transparent as possible, we also report (in column 1 and 2) the regression results that exclude interaction terms in the specification. All regressions include bank-specific and country-specific controls as in equation (4.1), except financial inclusion. All regressions also include bank fixed effect and year fixed effects. Unreported heteroskedasticity and autocorrelation consistent standard errors are calculated. T-statistics are reported in brackets.

Appendix 4.D

Table 4.D1

G20 Principles for Innovative Financial Inclusion and the Commitments of the Maya Declaration

Panel A	G20 Principles for Innovative Financial Inclusion
Leadership	Cultivate a broad-based government commitment to financial inclusion to help alleviate poverty
Diversity	Implement policy approaches that promote competition and provide market-based incentives for delivery of sustainable financial access and usage of a broad range of affordable services (savings, credit, payments and transfers, insurance) as well as a diversity of service providers
Innovation	Promote technological and institutional innovation as a means to expand financial system access and usage, including by addressing infrastructure weakness
Protection	Encourage a comprehensive approach to consumer protection that recognises the roles of government, providers, and consumers
Empowerment	Develop financial literacy and financial capability
Cooperation	Create an institutional environment with clear lines of accountability and coordination within government; and also encourage partnerships and direct consultation across government, business, and other stakeholders
Knowledge	Utilise improved data to make evidence-based policy, measure progress, and consider an incremental 'test and learn' approach acceptable to both regulator and service provider
Proportionality	Build a policy and regulatory framework that is proportionate to the risks and benefits involved in such innovative products and services and is based on an understanding of the gaps and barriers in existing regulation
Framework	Consider the following in the regulatory framework, reflecting international standards, national circumstances, and support for a competitive landscape: an appropriate, flexible, risk-based Anti-Money Laundering and Combating the Financing of Terrorism ML/CFT) regime; conditions for the use of agents as a customer interface; a clear regulatory regime for electronically stored value; and market-based incentives to achieve the long-term goal of broad interoperability and interconnection
Panel B	**Four commitments of the Maya Declaration**
1	Create an enabling environment to harness new technology that increases access and lowers costs of financial services
2	Implement a proportional framework that advances synergies in financial inclusion, integrity, and stability.
3	Integrate consumer protection and empowerment as a key pillar of financial inclusion.
4	Utilise data for informed policymaking and tracing results

Source: Soederberg (2013, p.598-599)

Table 4.D2

The Alliance for Financial Inclusion membership timing across countries

Country	Year	Country	Year	Country	Year	Country	Year
Afghanistan	2009	Colombia	2009	Malaysia	2009	South Africa	2010
Angola	2011	Ecuador	2010	Mongolia	2010	Tanzania	2010
Armenia	2011	El Salvador	2009	Mozambique	2011	Thailand	2009
Bangladesh	2009	Ghana	2010	Namibia	2011	Uganda	2009
Brazil	2010	India	2009	Pakistan	2009	Yemen, Rep.	2009
Burundi	2009	Indonesia	2009	Panama	2009	Zambia	2010
Cameroon	2009	Jamaica	2010	Philippines	2009		
Chile	2011	Kenya	2009	Rwanda	2009		

Source: http://www.afi-global.org/afi-network/members

Note: the years indicate when the country became a member of AFI and participated in cooperative and consultative efforts to enhance financial inclusion in their countries. 30 out of 87 countries' central bank have become members of AFI since 2009 in our sample period.

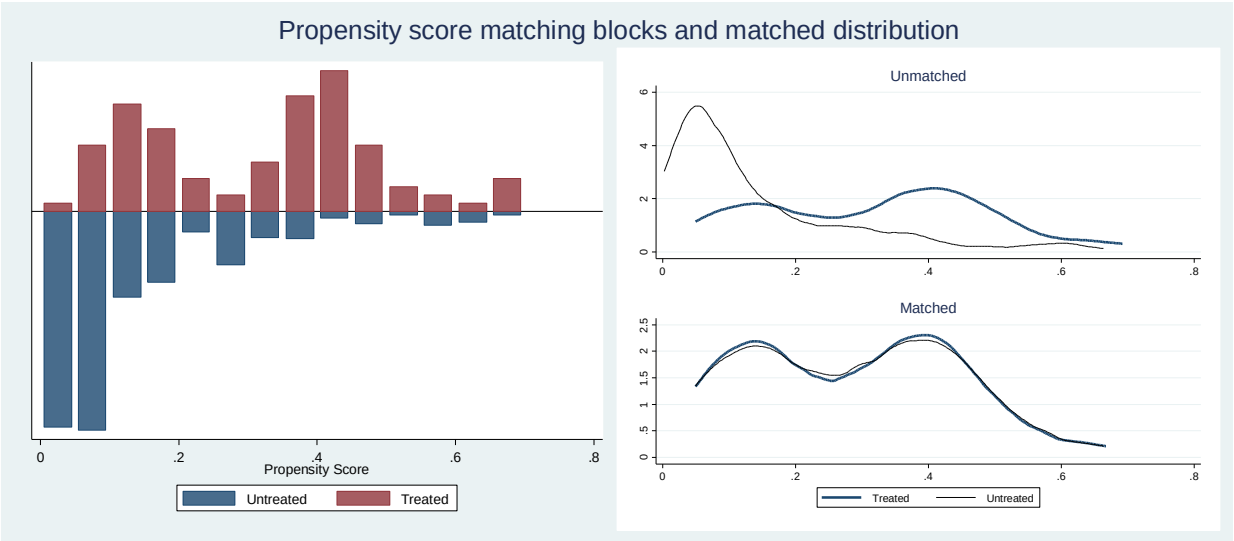
Table 4.D3

The propensity score matching analysis–Logit model and balancing tests

Variables	coefficients	z-statistics	Treated	Control	t-stats	p-value
Log of total assets	0.590***	[0.123]	6.66	6.92	-1.07	0.29
log of per capita GDP	-1.265***	[0.179]	7.31	7.44	-0.69	0.49
GDP growth rate	-0.117	[3.262]	0.05	0.05	0.32	0.75
Financial freedom	0.008	[0.013]	49.49	50.47	-0.44	0.66
Regulatory Quality	0.163	[0.341]	-0.18	-0.15	-0.25	0.8
Constant	3.862***	[1.374]				
Observations	539					
Chi-squared	95.42***					
Pseudo R-squared	0.19					
Hosmer–Lemeshow test (p-value)	0.3					
Standard deviation of the propensity score	0.17					

Note: The dependent variable, *Financial Access Policy* , takes the value of 1 for a country that participates in the AFI network in year 2009 and thereafter, or else zero. The detailed descriptions of the independent variables are given in Table 4.1. *Z-statistics* are reported in brackets. The Hosmer–Lemeshow test confirms the goodness-of fit of the logit model. Regarding balancing tests, we conduct t-tests of each independent variable used in the logit model. T-stats and P-values are reported along with respective values of the treated and control groups of the entire sample. Based on p-values, we cannot reject the null hypothesis that each characteristic is equal across the control and treatment groups in the full sample.

Figure 4.D1
Propensity score matching blocks and matched distribution



Note that while the left figure shows common support between the treated (a member of AFI network) and untreated/comparison groups (non-member), the right figure shows the distribution of the unmatched and matched sample. This visual description of the comparison of propensity score distributions between the member and non-member countries clearly indicates a satisfactory match.

Chapter V

Does financial inclusion affect bank efficiency? International evidence

Abstract

Financial inclusion is a widespread phenomenon across the globe and has become an important public policy priority following the global financial crisis. We show that banks in countries with greater financial inclusion enhance the levels of cost and profit efficiency. This effect is stronger when banks have lower competition and operate in countries with stronger rule of law and institutional quality. Exploiting cross-country and cross-time variation in the timing of countries moving into a global network of financial inclusion policymakers, we also further show that enabling an inclusive environment has a positive impact on bank efficiency. This effect is robust to instrumental variable analysis, controlling for bank fixed effects, alternative measures of bank efficiency and financial inclusion, for a sample of only commercial banks and developing countries, and other robustness tests.

5.1 Introduction

The seminal paper by King and Levine (1993) and subsequent literature underscores the important link between financial development and economic growth, a link that has spurred further exploration into various aspects of financial development and documents, not only positive correlations but also the causal effect of finance on growth in cross-country regressions.[98] Over the last decade, extending access of the low income groups to the formal financial sector has become an important public policy priority around the world. Most of the countries have undertaken numerous supportive regulatory reforms towards having more inclusive financial sectors, which is continuously being reinforced with the help of many multilateral agencies include the IMF, G20, the Alliance for Financial Inclusion (AFI), and the Consultative Group to Assist the Poor (CGAP). Consequently, the structure of the global banking markets has changed significantly, partially as a result of the inception of the operations of foreign banks in the developing countries. Since foreign banks "cherry pick" high net worth informationally transparent customers (Beck and Brown, 2014), domestic banks have increasingly searched for new opportunities and markets to increase their customer base (Demirgüç-Kunt, Beck and Honohan, 2008). Given the increased bank competition, and with the advancement of technology, a new frontier of financial intermediation emerges (e.g., mobile banking, agent banking), which allows banks to reduce transaction costs, acquire effective information, and enforce loan repayment (Bruhn and Love, 2014). The process of structural change and accompanying drive for new banking business has therefore manifested a desire for bank managers to explore new markets/customers and hence improve operating efficiency. Therefore, in this chapter, we, first, construct a composite index of financial inclusion by

[98] See, for example: Levine (1999); Wurgler (2000); Beck, Levine and Loayza (2000); and Bekaert, Harvey and Lundblad (2005). Most of the studies show that various aspects of financial development causally impact economic growth. For a detailed review of the literature see Levine (2005) and Pasalı (2013).

using supply-side data of *Financial Access Survey (FAS)* across 87 countries, and then investigate the link between financial inclusion and bank cost and profit efficiency for an international sample of 2913 banks for the period 2004-2012.[99]

Existing literature suggests several channels through which financial inclusion, that is, a greater inclusive financial sector, might affect efficient intermediation of the financial institutions. First, higher financial inclusion increases the opportunity for banks to expand their businesses to geographically distant customers by broadening the access of the unbanked poor people to formal financial services. Through geographic outreach, banks have the opportunities to diversify their funding and lending portfolios by exploiting managerial and technical expertise and improving managerial efficiency (Saunders, 1994; Berger and DeYoung, 2001; Deng and Elyasiani, 2008). When banks reach out to customers who are at the lower rung of the income ladder they are able to extract deposits from a large number of people, which is often the principal source of funds for banks (Calomiris and Kahn, 1991). Retail deposits are often dubbed sluggish, insensitive to risk and providing a stable cheaper source of long-term funding compared to wholesale funding that is sophisticated, relatively risky and expensive as wholesale funders possess critical information about the prospects of bank projects (see Song and Thakor, 2007; Huang and Ratnovski, 2011).[100] Rajan (1992) compares informed and arm's length debt and shows that former debt holders (i.e., wholesale funders) could ask for higher compensation for further funding if they sense any negative prospects of bank projects. A recent study by Demirgüç-Kunt and Huizinga (2010), using a sample of listed banks in 101 countries for the period 1995-2007, show that a higher level of non-deposit/wholesale funding shares lowers the rate of return on assets and/or bank soundness.[101] Using a sample of European

[99] Throughout this paper, we use the term "bank efficiency" to refer to both "cost efficiency" and "profit efficiency".
[100] See for example Shin (2009) and Goldsmith-Pinkham and Yorulmazer (2010).
[101] Beltratti and Stulz (2012) analyse overall performance of large banks around the World over the recent financial crisis period (i.e., July 2007 to December 2008). They find that banks financed with less (more)

Union countries, Poghosyan and Čihak (2011) also confirm that banks depending extensively on wholesale funding are more exposed to distress than those banks that are mostly depending on retail deposits. Overall, this would imply greater opportunities for banks extending the access of the disadvantaged groups to formal financial services with more inclusive financial sectors by attracting cheaper funding from a large pool of customers.[102]

Second, more inclusive financial sectors also provide greater opportunities for banks to reduce information asymmetries and agency problems between lenders and borrowers and thus increase efficient operations of financial institutions. Through diversifying lending strategy and extending credit to more productive areas of the economy, banks can increase efficiency. As banks operate in an inclusive financial sector, they are able to extend credit to a diverse set of customers and ensure efficient allocation of resources. With this process, they can acquire proprietary information about the customers which is at the heart of reducing informational asymmetries (Black, 1975; Fama, 1985). In an inclusive financial sector, banks can reduce *ex post* monitoring and transaction costs due to greater availability of borrower-specific information, particularly associated with lower income groups. Sharpe (1990) demonstrates that with asymmetric evolution of borrower information banks can increase ex post monopoly power in the loan market even if banks are ex ante competitive. Additionally, information related to households and firms can be more easily observed in an inclusive financial sector, which is likely to reduce any incentives for borrowers to default on their loans and make losses for lenders (Goldberg and White, 1998).[103] A recent study related to Chilean banks suggests that losses on large

short-terms funds in the money markets (deposits) performed better.

[102] Most of the emerging economies are continuously adopting pro-access policies to broaden financial inclusion. For instance: to get rid of financial untouchability, the Indian government has launched a scheme called the '*Pradhan Mantri Jan Dhan Yojana*' (Prime Minister's People Money Scheme) on 28 August 2014. Within two weeks of launch of this scheme, banks were able to accumulate *retail deposits* of Rs 1500 crore ($240 million), with around 30.2 million new accounts.

[103] De Mel, McKenzie and Woodruff (2008) in Sri Lanka and McKenzie and Woodruff (2008) in Mexico,

loans are unpredictable and greater compared to small loans (Adasme, Majnoni and Uribe, 2006). Extending the access of the poor customers to finance involves disbursing a large number of small credits, which are often a routine and standard task, and require fewer monitoring and screening costs. Furthermore, through financial outreach, banks reduce distance with a large number of customers.

By reducing lender-borrower proximity banks can enhance efficiency of financial intermediation while dealing with informationally opaque customers (e.g., Degryse and Ongena, 2005; Hauswald and Marquez, 2006; Mian, 2006; Deng and Elyasiani, 2008). In a theoretical model, Hauswald and Marquez (2006) show that with reduced distance banks are able to get a precise signal about the borrower. Therefore, further to the funding and lending opportunities, by reaching out to remote customers, banks reduce lender-borrower proximity, which in turn reduces cost of monitoring, and thus increases bank efficiency.

Third, the higher degree of financial inclusion also mitigates some exogenous risks (i.e., social and political disruptions), which may undermine efficient operations of financial institutions and stability (Hawkins, 2006). Recently, Bauchet, Marshall, Starita, Thomas and Yalouris (2011) summarised evidence from randomised evaluations of microfinance. Based on the findings of these randomized field experiments, they conclude that access to finance is positively correlated with many microeconomic indicators, including self-employment, business activities, household consumption, and well-being. More recent studies also show that greater financial inclusion reduces poverty (e.g., Bruhn and Love, 2014), unemployment (e.g., Prasad, 2010), bad decision making (e.g., Mani, Mullainathan, Shafir and Zhao, 2013). Burgess and Pande (2005) use state-level Indian data and show that opening bank branches in rural unbanked areas is associated with

using randomized experiments, show that microentrepreneurs are capable of paying high interest charged by microfinance institutions.

reduction in rural poverty.[104] Increasing financial inclusion therefore has a positive effect on economic and social stability which should have meaningful effects on the functioning of banking systems, and hence to the efficient operation of financial institutions.[105] Overall, we would expect that greater financial inclusion does matter for bank efficiency.

However, there may be a countervailing effect due to higher distance-related agency problems and organisational structure in financially more inclusive economies. First, in an inclusive financial sector, banks expand branches to unbanked remote areas. As distance increases between headquarters and distant branches, monitoring of the latter by senior managers becomes more difficult (see Brickley, Linck and Smith Jr, 2003). In this case, the farther away a branch is from the headquarters due to broadening access of the unbanked people to finance, the more difficult it gets to transmit efficiencies and aptitude of the senior managers to branches for enhancing overall operating efficiency.[106] Second, another offsetting effect may stem from a complex organisational and product structure associated with financial inclusion. Broadening the access of all income groups to financial services requires banks to maintain a large branch network and diverse product lines targeted to all customers. Inefficiency may arise due to lack of managerial and technical expertise, and agency problems related to complex organisational and product structure. Therefore, in the end, how an inclusive financial sector is associated with operating efficiency of financial institutions becomes an empirical question.

Our results indicate that there is a strong link between these variables. In particular, the higher the degree of financial inclusion, the better the banks' performance is in terms of increasing cost and profit efficiency. This result is robust in controlling for the country level of economic development and for an array of other indicators of the

[104] Using U.S. data, Jayaratne and Strahan (1996) show that relaxation of intra- and interstate branching of banks has a positive impact on economic growth.
[105] See Cull, Demirgüç-Kunt and Lyman (2012).
[106] Berger and DeYoung (2001) find that the extent of parent's control over the efficiency of affiliates declines as their distance increases.

institutional characteristics in which banks operate. To address potential omitted variable biases and reverse causality, which might bias the empirical results, we confirm our findings using an instrumental variable (IV) approach. We also confirm our findings using a subsample, and an array of other robustness tests.

Using the same analytical framework as mentioned above, we show that any beneficial effects of financial inclusion on bank cost (profit) efficiency tend to be more (less) pronounced in banking sectors with more (less) competition. We also show that the positive impact of financial inclusion on efficiency reinforces if the country in which banks operate has greater institutional quality. Specifically, greater freedom of expression and rule of law enhance the positive relationship between financial inclusion and bank efficiency. Showing the role of bank competition and institutional qualities on the access-efficiency relationship, combined with the IV approach, helps eradicate concerns stemming from endogeneity and omitted variables.[107]

Finally, to further corroborate our findings, we use a 'Quasi-natural experiment' type difference-in-differences (DID) approach to tackle the question of how being a member of the network of the financial inclusion policymakers (i.e., Alliance for Financial Inclusion), which set the stage for various supportive inclusive policies due to broadening financial inclusion impact bank efficiency. The DID result is consistent with the earlier findings that both cost and profit efficiency have increased significantly for those banks that operate in the countries that have created a pro-access environment for inclusive financial sectors. We also confirm our DID results by using a number of matching estimators including a recently developed bias-corrected covariate matching estimator proposed by Abadie and Imbens (2006). These matching estimators alleviate any sample selection bias and confounding factors providing unbiased treatment effects.

[107] Throughout this paper, we use the term "access-efficiency" and "financial inclusion-bank efficiency" interchangeably.

This paper aims to contribute to the existing empirical analyses in three important ways. First, we fill an important gap in the literature by providing new evidence on the impact of financial inclusion on bank efficiency using a large international sample for a period comprising the recent global financial crisis that took place in 2007/08. Since most of the empirical studies investigate the impact of access to finance on numerous socio-economic indicators (e.g., Butler and Cornaggia, 2011; Allen, Carletti, Cull, Qian, Senbet and Valenzuela, 2013; Demirgüç-Kunt, Klapper and Randall, 2013; Demirgüç-Kunt, Klapper and Singer, 2013), or on firm-level indicators (e.g., Beck, Demirgüç-Kunt and Martínez Pería, 2007; Beck, Lin and Ma, 2014), we incorporate multiple access dimensions for constructing a composite index of financial inclusion at country level, and then link the bank-level cost and profit efficiency scores obtained from stochastic frontier analysis (SFA), a technique that is extensively used in measuring the efficiency of individual banks.[108] The panel dimension of our composite index facilitates exploiting within country variation in the inclusiveness of financial sectors ensuring robust subsequent analyses in this paper. This study therefore contributes to the understanding about how inclusive financial sectors help reduce unbanked population and reduce distance between lenders and borrowers (i.e., reduce information asymmetries) and increase the efficiency of the financial institutions.

Second, we contribute to the literature on finance and growth by exploring the connection between important aspects of financial development and the efficiency of financial institutions. Well-functioning and efficient financial systems exert a first-order impact on economic growth and development (see e.g., Levine, 2005). The need for efficient financial systems was underscored during the recent global financial crisis. As a result, many multilateral organisations as well as national policymakers around the World

[108] See recent studies, Lensink and Meesters (2014) and Goddard, Molyneux and Williams (2014), that have applied stochastic frontier analysis to measure bank efficiency.

increasingly focus on improving access to finance by introducing favourable policies to promote better functioning of the banking systems. Our empirical findings unearth an important channel through which financial intermediation can augment economic growth while extending the access of all groups of people to financial services and increasing the operating efficiency of banks. Finding a link between these two important issues is also important as formal financial institutions used to perceive broadening the access of the disadvantaged groups who are at the bottom of the income pyramid as an antagonistic strategy for their performance because of high operating costs binding with the poor.[109] However, such a myopic view is subsiding as more financial institutions are increasingly focusing on microfinance style of operation realising the implications of access to finance on their performances as well as on the society in general.[110] Recent studies suggest that almost 2.5 billion adults, just over half of the world's adult population, do not use any form of formal financial services with only 41% of people in the developing countries compared to 89% in developed ones having bank accounts (Kendall, Mylenko and Ponce, 2010; Demirgüç-Kunt and Klapper, 2012). Reviewing a body of recent studies, Cull, Ehrbeck and Holle (2014) conclude that including non-banking people into the formal financial systems is an important component for economic and social progress. Therefore, identifying policy areas that have a first-order effect on increasing efficiency of the financial institutions is critical for policymakers to spur inclusive economic growth as

[109] See Cull and Spreng (2011) for a study on the privatisation of the National Bank of Commerce (NBC) of Tanzania which was split into two banks namely New NBC and the National Microfinance Bank (NMB). While the former had only 35 bank branches and had business lines targeted to commercial enterprises and individuals, mostly located in urban centres, the latter had 95 bank branches and had the objectives of fostering access of the disadvantaged groups of the rural and urban centres to finance. Both breakaway banks were able to improve their profitability and the share of performing loans eventually. However, the initial growth of credit of New NBC was slow whereas NMB had decent growth. This is an example that shows how broadening access of the poor people to financial services does not reduce efficiency of banks.

[110] For example: Grameen Bank of Bangladesh, Bank Rakyat Indonesia, Khushhali Bank in Pakistan, BancoSol in Bolivia, Banco Solidario in Ecuador, MiBanco in Peru, Banco Azteca in Mexico, and K-Rep Bank in Kenya are most of the recent success stories that show how commercially-oriented microfinance banks can achieve high operating efficiency and become profitable while serving the poor. For more on commercially-mined microfinance bank see Harper and Arora (2005) and Bruhn and Love (2014).

efficiency gains increase availability of more productive loans and overall economic development (Fries and Taci, 2005).

Third, our paper contributes to the literature that explores the determinants of bank efficiency (e.g., Berger, Demsetz and Strahan, 1999; Rossi, Schwaiger and Winkler, 2009; Barth, Caprio and Levine, 2013; Chortareas, Girardone and Ventouri, 2013). Despite the extensive literature on bank efficiency (see Berger, 2007, for reviews of the literature), a systematic study on whether an inclusive financial sector increases or decreases efficient operation of banks does not yet exist. This is mainly due to limited data availability for a long period of time across countries and lack of development of a reliable quantitative index of financial inclusion.

The remainder of the paper is organised as follows: Section 5.2 describes the data and methodology. Sections 5.3 and 5.4 discuss the empirical results and the sensitivity analyses, respectively. Section 5.5 provides further evidence on whether pro-access policies improve the functioning of financial systems using 'Quasi-natural experiment' type analysis, and Section 5.6 concludes with some policy implications.

5.2 Data and Methodology

To test the relationship between financial inclusion and bank efficiency, we combine bank- and country-level data from various sources including the IMF Financial Access Survey (FAS) data for the construction of the financial inclusion index. This section discusses the assorted data sources, variables and methodology that we use in this paper. In this effort, we start with basic regression analysis, and then control for bank- and country-specific heterogeneity and focus on alleviating the possible endogeneity and omitted variable biases that might distort the relationship between financial inclusion and bank efficiency. Table 5.1 provides definitions and sources of all the variables.

5.2.1 Data sources

We use a unique and comprehensive supply-side data set from the International Monetary Fund's (IMF) Financial Access Survey to measure the degree of financial inclusion incorporating multiple dimensions of inclusiveness of the financial sector. The Financial Access Survey (FAS) has been conducted over the past fifteen years in over 186 economies to gather a large number of indicators on financial access and usage which are comparable across economies in the world. The access data was initially collected by Beck, Demirgüç-Kunt and Martínez Pería (2007) with the joint effort of the World Bank for 2003-2004, and later on extended by the Consultative Group to Assist the Poor (CGAP) and by the IMF.

The use of FAS data in cross-country work has been increasingly ubiquitous in the recent past (see e.g., Beck, Lin and Ma, 2014) and has numerous advantages over the use of demand-side household-level data (i.e., Global Findex) as introduced recently by Demirgüç-Kunt and Klapper (2012) for the calendar year 2011. First, Beck, Demirgüç-Kunt and Martínez Pería (2007) show that higher branch penetration and the number of deposit/loan accounts per capita are associated with a higher share of households and firms that use formal financial services. They also show that firms report lower financing constraint if they operate in an environment where financial outreach and the number of deposit/loan accounts per capita are higher. Second, FAS provides numerous country-level access data including demographic and geographic branch/ATM penetration, the number of deposits and loans per capita, and the total volume of outstanding deposit and loans for a large number of economies and for a long period starting from 2004, which are indispensable to the construction of a comprehensive index of financial inclusion. Third, unlike the micro-based measures of access which are often very costly and hard to get for a long period of time for a large number of economies, FAS allows us to explore the relationship between financial inclusion and bank efficiency over time and exploit the

within-country variation in financial inclusion of any given banking system.

Given the trade-off between data availability (e.g., availability of required dimensions of financial inclusion) and cross-country sample coverage, we manage to measure financial inclusion index for 87 countries over the period 2004 to 2012, and match the year of FAS data with the year of bank-level data. We use a large amount of individual bank-level data sourced from unconsolidated reports of banks compiled from the BankScope database provided by Bureau van Dijk and Fitch Ratings.[111] Our dataset comprises 2,913 commercial banks, cooperative banks and Islamic banks (14,929 bank-year observations) operating in 87 countries over the time period 2004-2012, which represent, respectively 52.8%, 46.2%, and 1.0% of the sample.

5.2.2 Measuring bank efficiency

There are numerous cross-country or single country studies on the measurement of bank efficiency. In this paper, we follow Turk Ariss (2010) and identify two frontier models, namely cost frontier and alternative profit frontier, to measure cost and profit efficiency of individual banks by using stochastic frontier analysis (SFA).[112] Cost and profit efficiency scores measure the proximity of a bank's cost or profit relative to a best practice bank's cost or profit in a particular sample for producing the same output bundle under the same exogenous conditions. The intermediation approach of Sealey and Lindley (1977) is followed where financial institutions collect deposits and other liabilities and use them to produce interest-earning assets, that is, loans and investments. The empirical specification of the cost frontier is the following:

[111] We discard unconsolidated reports of banks whenever consolidated ones of the same group are available in order to avoid any double counting of institutions.

[112] We choose parametric, SFA, as it allows measurement error in the estimation and is not sensitive to outliers and measurement errors unlike the non-parametric techniques, that is, Data Envelopment Analysis (see Kumbhakar and Lovell, 2003, for details on this technique). For details on parametric and non-parametric techniques, see Matousek and Taci (2004).

$$\begin{aligned} \ln \mathrm{TOC}_{it} &= \alpha_i + TOC(Q,\ W;\ \beta) + \delta Btype_j + \zeta\, year_t + \varepsilon_{it} \\ i &= 1,...,\mathrm{I} \\ t &= 1,...,T \end{aligned} \tag{7.1}$$

where TOC_{it} is either total operating costs or total profits of bank i at time t, Q is the output i.e., total assets and W is a set of input prices. Three input prices are used where w_1 is the price of funds; w_2 is the price of labour; w_3 is the price of capital of bank i at time t. We impose homogeneity of degree one on input prices and divide all factor prices and TOC_{it} by w_3. We include bank type (commercial, co-operative and Islamic) and year dummies denoted by $Btype$ and $year$, respectively. A vector of unknown parameters β will be estimated. For the case of cost inefficiency, the total error in equation (5.1) is $\varepsilon_{it} = v_{it} + u_{it}$, where v_{it} denotes random noise, and u_{it} stands for deviations due to inefficiency, while for the case of profit inefficiency it is $\varepsilon_{it} = v_{it} - u_{it}$. The random noise term v_{it} is assumed to be i.i.d with $v_{it} \sim N(0, \sigma_v^2)$, and independent of the explanatory variables. The inefficiency term u_{it} is assumed to be i.i.d with $u_{it} \sim N(0, \sigma_u^2)$, and independent of v_{it}. We assume that inefficiency terms of the banks in our sample change considerably over time; controlling for bank fixed effects will allow us to distinguish inefficiency from the unobserved heterogeneity. Therefore, failure to account for unobserved heterogeneity in the efficiency modelling will provide biased efficiency scores of individual banks.[113] α_i is included in equation (5.1) to control for bank fixed effects, and it is correlated with the output, inputs and quasi-fixed input of banks (Greene, 2005).[114] We also allow for bank type to directly affect cost (profit) function by adding a set of dummies of bank types in the stochastic frontier.

Profit efficiency is measured using the alternative profit frontier. We choose

[113] Using data on German savings banks, Bos, Koetter, Kolari and Kool (2009) show that efficiency scores of banks are sensitive to the treatment of heterogeneity in the stochastic frontier model.
[114] Following banking literature, we treat equity as the quasi-fixed input.

alternative profit frontier over standard profit function as the former assumes that financial institutions take the output quantities and the input prices as given and maximise profits by adjusting output prices and input quantities (Duygun, Sena and Shaban, 2014).[115] In this case, we replace TOC_{it} with PBT_{it} , that is, profit before tax as the dependent variable. Additionally, we follow Bos and Koetter (2011) and use a negative profit indicator (NPI) in the profit function as many of our banks in the sample reported a loss. In this paper, we use the True fixed effects stochastic frontier model to calculate cost and profit efficiency. Using maximum likelihood technique, equation (5.1) is estimated separately for each country due to measuring bank efficiency relative to a country best practice frontier.

5.2.3 The construction of financial inclusion index

In constructing the financial inclusion index, we use three dimensions namely Accessibility/Penetration, Availability, and Usage that are identified by the policy makers as the main indicators of financial inclusion. For the accessibility dimension, we use the number of bank accounts per 1,000 people in order to integrate the depth of the financial access.[116] The availability dimension is used to account for the pervasiveness of outreach of the financial sector in terms of banks' physical outlets, as physical distance to physical point of financial services is deemed an important impediment to financial inclusion (see Allen, Carletti, Cull, Senbet and Valenzuela, 2014). We use two classes of penetration of banking services i.e., demographic and geographic penetration of bank branch and ATM, and create four sub-indices (see Beck, Demirgüç-Kunt and Martínez Pería, 2007). For the demographic penetration, we use the number of bank branches and number of ATMs per

[115] Giver the international sample in this paper, we prefer alternative profit frontier as it does not require having perfect competition assumption.
[116] Measuring penetration dimension, the number of accounts per capita is used as data on the number of people having bank accounts is limited. In the former case there is a possibility of double counting the same person on having multiple accounts.

100,000 people, and for the geographic penetration we use the number of bank branches and number of ATMs per 1,000 square kilometres. For the usage dimension, we use the volume of credit plus deposit relative to the GDP. However, one could incorporate many other dimensions (e.g., affordability) that may reflect the "transaction costs" and "ease of transaction" to have a more comprehensive measure of financial inclusion. We do not take affordability dimension in the construction of our index due to the limitations of comparable macro data across economies.[117] Since using standalone indicators of financial inclusion would provide an incomprehensive picture of inclusiveness of the financial sectors, and hence have implications on bank efficiency, we build upon Beck, Demirgüç-Kunt and Martínez Pería (2007) to construct a composite weighted index of financial inclusion using a two-stage principal component analysis (PCA) as follows:[118]

$$FII_{jt} = 0.71 * Penetration_{jt} + 0.71 * Availability_{jt} + 0.06 * Usage_{jt} \quad (7.2)$$

PCA is a common statistical approach for data reduction which is intended to explain the variance of the observed data using linear combinations of a large set of variables. In other words, PCA allows for the extraction of necessary information common to a number of variables. First, we apply PCA to estimate the availability dimension from a group of four sub-indices related to outreach mentioned above. Second, we apply PCA again to estimate the overall financial inclusion index (FII) by using three dimensions of the inclusive financial sector: the penetration, availability and usage as causal variables.[119]

[117] Incorporating information, that is, the annual fees charged to customers for ATM cards and/or accounts (i.e., transaction costs) and the minimum amount and/or document requires opening savings or checking accounts (i.e., ease of transaction), would have improved the quality of financial inclusion index.
[118] See Tetlock (2007) for details on principal component analysis.
[119] Before using PCA, first, we winsorise each indicator at the 95th percentile levels to reduce the influence at the upper tail. Second, we normalise each indicator to have values between zero and one to show the scale at which they are measured is immaterial.

In PCA, the first principal component is the single linear combination of the financial inclusion indicators that explains the most of the variation.

The results of the PCA are reported in chapter IV (see Table 4.A1). In the case of availability dimension, the first principal component (PC) explains about 70% of the variations with the eigenvalue of more than one, that is, 2.81 (see Panel A). The availability dimension is calculated using weights (i.e., 0.52, 0.52, 0.47, and 0.48) assigned to the first PC. Constructing the financial inclusion index, we find three PCs with eigenvalues of 1.54, 0.99, and 0.45. Again, the first PC explains about 51% of the corresponding sample variance (see Panel B). Since only the first PC has an eigenvalue that is more than one, according to the Kaiser rule, we assume that it sufficiently explains the common variation among the three dimensions.[120] The parametric methods that we have applied for constructing FII assigns factor loadings (weights) on each dimension. We use these weights to construct FII as in equation (5.2). It is noted that usage dimension has relatively much lower weights than the penetration and availability dimensions.[121] We normalise FII and assign each country along a 0-1 scale for ease of interpretation in the subsequent analyses, where zero indicates financial exclusion and one indicates financial inclusion.[122]

Following Beck, Demirgüç-Kunt and Martínez Pería (2007), we conduct numerous verification tests to gauge the strength of our index. We use demand-side information of the Global Findex database, and find that our index is positively and significantly associated with the share of household account. The correlation between

[120] Dropping some PCs may help reduce a portion of noise components from our data, and ensures reliability of the subsequent analyses in this paper.

[121] In the spirit of Tetlock (2007), we check the stability and robustness of our financial inclusion index. In this effort, we use PCA on a year-by-year basis in which loadings are determined annually instead of over the entire sample period. The correlation between these two indices (one where the loadings are derived over the entire sample period and the other derived annually) is very high (i.e. 0.98), indicating the robustness of our index irrespective of how loadings are determined.

[122] Our primary objective in this paper is to explore the effects of an inclusive financial sector on bank cost/profit efficiency for the period 2004-2012; therefore, FII is constructed across countries and period due to taking into account the evolution of financial inclusiveness.

predicted share of household account and the actual share of household account at financial institutes is 76%. In addition, using a unique data set across 64 countries and over 38,987 firms of the World Bank Enterprise Surveys (WBES), we also find the expected relationship between our index and a firm's financing obstacle. In particular, we find that financing obstacles are negatively and significantly related to an inclusive financial system.[123]

5.2.4 Measuring bank competition

The Lerner index is employed to measure bank competition as it is the most accurate and the only computable market power indicator that varies at the bank-level (Berger, Klapper and Turk-Ariss, 2009; Carbó-Valverde, Rodriguez-Fernandez and Udell, 2009; Beck, De Jonghe and Schepens, 2013). The Lerner index estimates the ability of pricing power by measuring the disparity between price and marginal costs as a percentage of price. Put differently, it estimates the degree to which a financial institution is able to enhance its marginal price beyond its marginal costs. The Lerner index is calculated at the bank-level as follows:

$$Lerner_{it} = \frac{P_{it} - MC_{it}}{P_{it}} \tag{7.3}$$

where P_{it} is the price of total assets proxied by the ratio of total revenue (interest and non-interest income) to total assets for bank i at time t. MC_{it} is the marginal costs of producing an additional unit of output. Marginal cost is calculated by using stochastic frontier analysis (SFA) following conventional bank efficiency studies (e.g., Turk Ariss, 2010). The estimated marginal costs and price are used in equation (5.3) to measure the Lerner index, a conventional Lerner index (C-Lerner). It is the inverse of the degree of

[123] All verification tests of the financial inclusion index are available from the authors upon request.

bank competition, and is given by the range of 0 < Lerner index <1. When there is perfect competition, the Lerner index = 0; in the case of a pure monopoly, the Lerner index = 1. A Lerner index < 0, indicates pricing below the marginal cost and could result, for instance, from sub-optimal bank behavior (Fu, Lin and Molyneux, 2014). For robustness test, we also follow Koetter, Kolari and Spierdijk (2012) and calculate efficiency-adjusted Lerner index (E-Lerner) (as explained in Appendix 4.B). E-Lerner does not assume full bank efficiency and therefore unlike C-Lerner it accounts for bankers' ability to exploit output pricing opportunities resulting from market power.

5.2.5 Bank-specific and macro control variables

To investigate the impact of financial inclusion on bank efficiency, we make use of a number of control variables. These controls are bank characteristics and characteristics of the macroeconomic environment that can be correlated with the bank efficiency. Specifically, we use six main bank-level controls. First, loan ratio is the ratio of loans to asset accounts for liquidity risk of individual banks. Second, total assets is the logarithm of assets to proxy for bank size. Third, LLP, the ratio of loan loss provision to loans, is used to account for an individual bank's loan portfolio risk. Fourth, income diversification, the ratio of non-interest income over total operating income, is included to account for the effect of off-balance sheet activities of individual banks. Fifth, better management quality is often associated with high levels of bank efficiency, and the ratio of total earning assets to total assets is used to proxy for management quality. Sixth, equity is the ratio of equity to assets and it is used to control for capital risk. Next, there are two macroeconomic control variables. First, GDP is used to control for economic growth. Second, since the inclusive financial sector is associated with the level of economic development, controlling for GDP per capita is critical due to extracting a robust link between financial inclusion

and bank efficiency.[124]

We also include an array of additional country-level variables related to institutional qualities and instrumental variables. The former is compiled from the Kaufmann, Kraay and Mastruzzi (2010) Governance Index database, and the latter is from the Heritage Foundation and Doing Business database. Considering the objective of this paper, we exclude countries for which we have no information on different dimensions of the financial inclusion index. We deflate all monetary values to 2005 (2005 = 100) prices using the GDP deflator of U.S. obtained from the WDI. The deflated series are reported in millions of U.S. dollars ($).

5.2.6 Descriptive statistics

Table 5.2A reports descriptive statistics of all variables, while Table B5.1 presents the correlations between the different variables. The average cost (profit) efficiency is 0.81 (0.56) with a standard deviation of 0.29 (0.32). The higher standard deviation of profit efficiency relative to cost efficiency suggests that there is substantial variation in the levels of profit efficiency scores. The average of the variable of interest, financial inclusion index, is 0.56 with standard deviation of 0.29. The large standard deviation indicates considerable heterogeneity in the inclusiveness of financial sectors across 87 countries. Table 5.2B reports the average values for these variables across the countries in our sample, where ranks of the countries are in parentheses based on the financial inclusion index. According to the rank, South Korea, Belgium and Japan have the most inclusive financial sector, whereas Afghanistan, Yemen and Malawi have the least inclusive. The country-level correlations indicate that financial inclusion is higher in countries with greater economic

[124] See Honohan (2008).

development, freedom of expression, political and social stability, government effectiveness, regulatory quality, rule of law, control of corruption and overall institutional quality, thereby underscoring the need for investigating the role of these indicators in the access-efficiency relationship (see table 5.A1).[125]

5.2.7 Methodology

To examine the impact of financial inclusion on bank efficiency, we run several regressions using the following baseline model:

$$Bank\ efficiency_{ijt} = \beta_0 + \beta_1 Financial\ Inclusion_{jt} + \beta_2 BC_{ijt} + \beta_3 KC_{jt} + Year_t + \varepsilon_{ijt} \qquad (7.4)$$

where the *i, j* and *t* subscripts indicate bank, country and year, respectively. *Bank efficiency* is either cost efficiency or alternative profit efficiency, measured at the bank level. *BC* and *KC* are bank- and country-specific control variables, respectively. Table 5.1 provides detailed definitions of all variables that are used in this paper. Our main explanatory variable of interest is *Financial Inclusion*, measured at the country level. *Year* is a yearly dummy variable controlling inter alia for other macroeconomic and time varying global business cycle effects. Since bank competition is one of the important determinants of bank efficiency, given the recent development we use two variant measures of Lerner indices namely conventional and efficiency adjusted Lerner indices to proxy bank competition, and at the same time to see the robustness of our results.[126] We

[125] Since financial inclusion is highly correlated with the level of economic development and institutional qualities, we have computed the variance inflation factors (VIF) for each of our model estimates. The average VIF never exceeds 3, suggesting that multicollinearity is not a cause for concern for the outcomes in this paper. See Lensink, Meesters and Naaborg (2008) for details on institutional quality and bank efficiency.

[126] Lagged values of one period of Lerner indices are used throughout this paper in order to alleviate any endogeneity issues that might be associated with market power and bank efficiency (see e.g., Turk Ariss, 2010; Love and Martínez Pería, 2014).

use a Tobit model for the regression of bank efficiency, as these variables are bounded between zero and one. To gauge both the statistical as well as economic significance of our regression results, we report marginal effects in lieu of coefficient estimates. A positive and significant β_1 would indicate that greater financial inclusion is associated with higher levels of cost and profit efficiency of banks. Given that our results might suffer from endogeneity and omitted variable biases, we also estimate instrumental variable (IV) and random effects Tobit regressions, discussed in great length later.

Since the impact of lack of access to finance may rely on the competitiveness in the markets, and the environment in which the bank operates, we also see the interactive effect of financial inclusion with bank-level competition and country-level institutional qualities in the following regression models:

$$\begin{aligned} Bank\ efficiency_{ijt} = {} & \beta_0 + \beta_1 Financial\ Inclusion_{jt} + \beta_2 BC_{ijt} + \beta_3 Bank\ Competition_{ijt} \\ & + \beta_4 Financial\ Inclusion_{jt} \bullet Bank\ Competition_{ijt} + \beta_5 KC_{jt} + Year_t + \varepsilon_{ijt} \end{aligned} \tag{7.5}$$

$$\begin{aligned} Bank\ efficiency_{ijt} = {} & \beta_0 + \beta_1 Financial\ Inclusion_{jt} + \beta_2 BC_{ijt} + \beta_3 KC_{jt} + \beta_4 Institutional\ Quality_{jt} \\ & + \beta_5 Financial\ Inclusion_{jt} \bullet Institutional\ Quality_{jt} + Year_t + \varepsilon_{ijt} \end{aligned} \tag{7.6}$$

where *Bank Competition* is either conventional or efficiency-adjusted Lerner indices and *Institutional Quality* is the Governance Index of Kaufmann, Kraay and Mastruzzi (2010). We expect a positive coefficient on the interaction of financial inclusion with *Bank Competition* and *Institutional Quality*, as more individual bank market power and better institutional settings would complement the positive relationship between financial inclusion and bank efficiency. Since six indicators of institutional quality are highly correlated with each other, we run regression using each indicator and its interaction term with financial inclusion one at a time to avoid the multicollinearity problem. In

addition, we create a composite index of institutional quality by capturing common variation among these six indicators using PCA, and run regressions. We report Tobit regressions of these interaction effects as well as derive marginal effects to gauge economic significance. As robustness tests, we also treat financial inclusion, bank competition (institutional quality) and their interaction terms as endogenous variables and instrument them via the instrumental variables listed in Table 5.1.

5.3 Empirical results

In this section, combining both bank-level and country-level variables, we test whether greater financial inclusion is associated with higher cost and profit efficiency of banks. We first explore the effect of cross-country variation in financial inclusion, before examining the role of the variations of bank competition and various institutional qualities on the relationship between financial inclusion and bank efficiency. We also use bank-level random effects Tobit regressions to control for bank-specific unobserved heterogeneity and IV analysis to control more rigorously for endogeneity and omitted variable biases. We report both statistical and economic significance of our results to gauge the importance of this relationship.

5.3.1 Financial inclusion and bank efficiency

The results in Table 5.3 show a statistically and economically significant relationship between financial inclusion and bank efficiency across a sample of 2913 banks in 87 countries. We report pooled cross-sectional Tobit regressions that include unreported year dummies and heteroskedasticity-robust standard errors.[127] Considering the recent

[127] We confirm our results using ordinary least squares regressions that include year dummies and heteroskedasticity and autocorrelation-consistent (HAC) standard errors. The results are quantitatively similar, and available from the authors.

development in the measure of bank competition, we report two variant measures namely conventional Lerner index (i.e., C-Lerner) and efficiency adjusted Lerner index (i.e., E-Lerner) as the proxy for bank competition. In columns 1 and 2, our dependent variable is cost efficiency whereas profit efficiency is in columns 3 and 4. In all models we use bank- and country-level control variables.

As can be seen from Table 5.3, financial inclusion is associated with a higher level of cost and profit efficiency of banks. Financial inclusion enters positively and significantly in all four regressions. If a country wants to increase its financial inclusion by one point, the expected cost and profit efficiency of the bank would increase by 0.32 and 0.06 while holding all other variables in the model constant, respectively. Thus, the higher a country's financial inclusion, the higher the predicted cost and profit efficiency of the banks. The effect is also economically significant. A one standard deviation increase in *Financial Inclusion* increases the *Cost* and *Profit efficiency* by 12% and 3%, respectively.[128] It is obvious that when financial intermediaries operate in a more inclusive environment they may be more likely to engage in activities and allocate resources more efficiently to a wide range of the population which helps increase operating efficiencies. It is also the case that the homogeneous and predictable nature of small loans requires less time and monitoring costs than larger ones, and hence allows banks to be more cost and profit efficient. The recent empirical evidence also supports our results impliedly that by expanding bank branches and/or reaching out to customers by diversifying geographically and/or diversifying loan portfolios (i.e., financial inclusion), banks improve operating efficiency (e.g., Grabowski, Rangan and Rezvanian, 1993; Berger and DeYoung, 2001; Bos and Kolari, 2005; Deng and Elyasiani, 2008; Rossi, Schwaiger and Winkler, 2009).

Turning to the control variables, banks with smaller size, greater competition, and

[128] Throughout this paper marginal effects and elasticities are calculated at the means of all variables.

better management are more cost efficient, whereas banks with greater loan portfolio, equity capital, market power, and lower loan loss provisioning are more efficient in terms of profitability. Regarding country-level macro controls, the results suggest that higher economic growth and levels of economic development are associated with lower cost and profit efficiency.

5.3.2 The role of bank competition and institutional quality

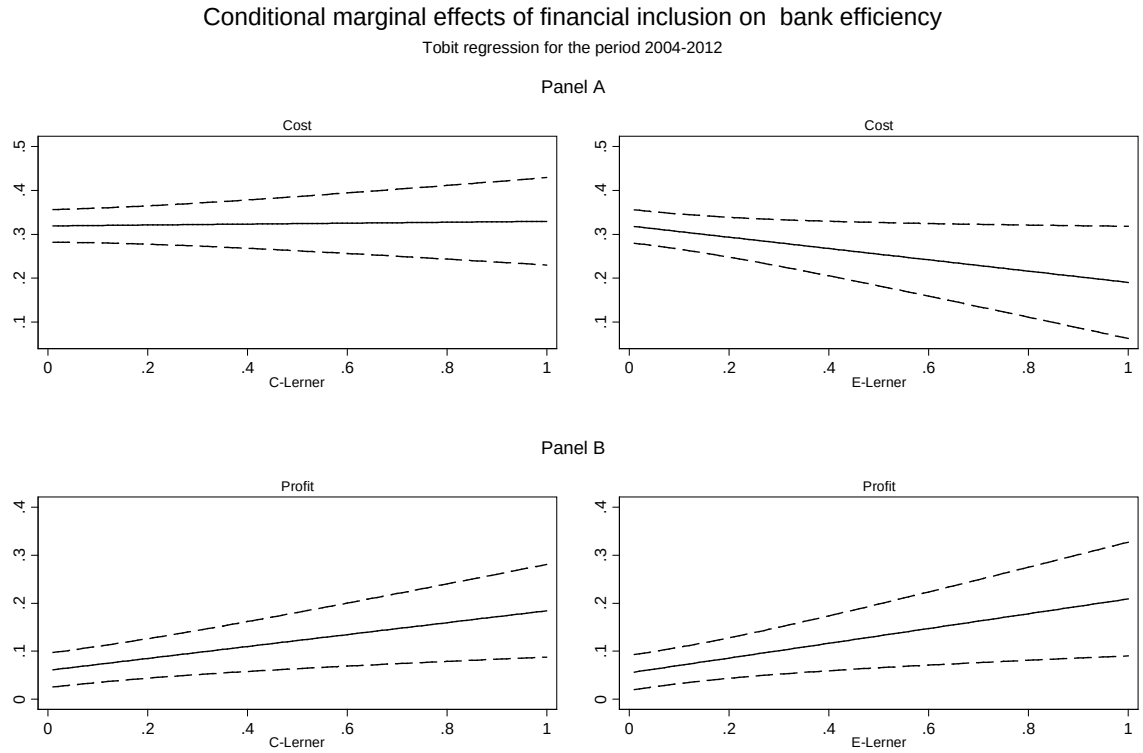
The interaction effects of financial inclusion and bank competition are presented in Table 5.4. In column 2, we find a negative and significant interactive effect of financial inclusion and bank competition on cost efficiency. The negative coefficient suggests that the positive impact of financial inclusion on cost efficiency is more pronounced if banks are more competitive. At the mean of all variables including efficiency-adjusted Lerner index (E-Lerner = 0.14), the marginal effect of financial inclusion is -0.16. This effect implies that one standard deviation increase in E-Lerner (0.25), leads to a decline in cost efficiency of a little less than 4%. This evidence suggests that the magnitude of the positive impact of financial inclusion on bank cost efficiency increases if it has lower (higher) market power (competition). On the contrary, we find positive and significant interactive effects on profit efficiency. It suggests that the higher pricing power of individual banks increases the positive effects of financial inclusion on profit efficiency. Taking column 4, at the mean of all variables including E-Lerner (0.14), the marginal effect of financial inclusion is 0.28, which implies that one standard deviation increase in market power (0.25) would increase profit efficiency by almost 7%.

Following Brambor, Clark and Golder (2006), we use marginal effect to show the influence of different levels of bank competition on the impact of financial inclusion on bank efficiency. In Figure 5.1, we graphically illustrate the estimated total marginal effects and standard errors of financial inclusion. Panel A (right) shows a downward slope

indicating as market power increases the positive impact of financial inclusion on bank cost efficiency decreases. Panel B shows that as pricing power of an individual bank increases the positive impact of financial inclusion on profit efficiency increases. These outcomes are consistent with existing literature as Marquez (2002) theoretically shows that increasing competition can induce banks to lend excessively to less creditworthy borrowers, thereby decreasing efficiencies.

Figure 5.1

Marginal effect of financial inclusion on cost efficiency



Note that it corresponds with our results in Table 5.4. The graphs on the upper panel display the marginal effect of financial inclusion on cost efficiency at different levels of market power i.e., C-Lerner (left) and E-Lerner (right). It shows that the positive impact of financial inclusion on cost efficiency decreases as market power increases. The graphs on the lower panel display the marginal effect of financial inclusion on profit efficiency at different levels of market power i.e., C-Lerner (left) and E-Lerner (right). It shows that the positive impact of financial inclusion increases as market power increases.

Regarding the interactive effects of financial inclusion with institutional quality, we use efficiency-adjusted Lerner indices as the measure of bank competition for brevity's

sake. For expositional brevity, and because we are interested in the interaction effects the results of the controls are not reported.

Most of the interaction terms enter positively and significantly at the 1% level. Columns 1-6 Table 5.5 suggest that the benefit of having greater freedom of expression and free media (Voice), political stability (Political), effective governance regulatory quality (Regulatory), rule of law (Law), and control of corruption in increasing cost efficiency is more pronounced in the markets where financial inclusion is higher. At the bottom of the table, we report the marginal effect of financial inclusion at the mean of each indicator. In column 7, we use the first principal component (the only component that has an eigenvalue of more than one i.e., 5.27 with 87% variation) of all institutional variables (e.g., Voice, Political, Government, Regulatory, Law and Corruption) and create a composite index of 'Institutional Quality' and run the regression. The interaction term in column 7 also confirms our results that the positive impact of institutional quality on enhancing cost efficiency is higher if the bank operates in an inclusive financial system.

In terms of the economic significance, the magnitude of the coefficient suggests that there is a significant effect of financial inclusion on bank cost efficiency in the countries with the highest levels of institutional development. For instance, using estimated coefficients in column 7, at the mean of institutional quality index (IQI) (-0.01), the marginal effect of financial inclusion is 0.08. Therefore, for one standard deviation increase in the overall institutional quality (2.29), there would be an 18% increase in the relationship between financial inclusion and cost efficiency. These findings are consistent with existing empirical literature as Beck, Demirgüç-Kunt and Maksimovic (2005) and Beck and Demirgüç-Kunt (2006) show that greater institutional development (e.g., financial, legal and corruption) facilitates better access to finance, especially for the smallest firms; for example: more effective rule of law provides more flexibility in terms of contract enforcement without much delay. Overall, the positive interactive effects seem

to suggest that the beneficial effects of financial inclusion on bank cost efficiency reinforce if the market within which banks operate has greater quality of institutional settings.

In Table 5.6, we report the results of the interactive effects on profit efficiency. While columns 1 and 4 show that greater freedom of expression and regulatory quality is detrimental, column 5 shows that better rule of law complements the relationship of financial inclusion and bank profit efficiency. Regarding overall institutional quality, we find that the interactive effect is positive and significant at the 10% level where the marginal effect of financial inclusion at the mean of all variables is 0.03. This effect implies that for one standard deviation increase in IQI, there would be an 8% increase in the profit efficiency.

5.4 Additional sensitivity analysis

In this section, we discuss various additional robustness tests of our study. Regarding IV regressions, we report endogeneity, under-identification and over-identification tests. We use alternative measures of financial inclusion and bank efficiency. We split the sample into terciles based on financial inclusion and re-run regressions keeping only commercial banks or developing countries.

5.4.1 Instrumental variable regression

Endogeneity is deemed to be a concern in cross-country studies. It is possible that the results of our study may be biased because of the endogeneity problem between financial inclusion and bank efficiency. Endogeneity can arise if banks engage in less efficient activities in the current set-up and venture into unbanked areas and/or if they self-select into inclusive financial activities because these reward them with greater market power and profitability. In addition, despite controlling for an array of bank- and country-specific variables, as our regressions link country-level financial inclusion to bank-level efficiency, omitted variable bias could still be of concern. It may be the case that the composite index that we construct to proxy for financial inclusion may be subject to

measurement error. Therefore, to alleviate any endogeneity and omitted variable biases, and measurement errors, we employ the Tobit model with instrumental variables, using Newey's minimum chi-squared two step estimator.

To address the concern of the potential endogeneity problem, we search extensively for instrumental variables and find that remittance flow to GDP and government bank ownership is suitable as instruments. The former is obtained from the World Bank Global Financial Development Database, a detailed description of which is available in Cihak, Demirgüç-Kunt, Feyen and Levine (2012). The latter is obtained from the Bank Regulation and Supervision Database compiled by Barth, Caprio and Levine (2013). The detailed definitions of these variables can be found in Table 5.1. Intuitively, remittance flow and government bank ownership should have a direct impact on the development of an inclusive financial system, but not affect bank efficiency directly.

Table 5.B1 shows the First-stage regressions of financial inclusion on instruments used in this study. We find that all instruments have statistically significant effects on financial inclusion. The results are interesting as they show that remittance flow and government bank ownership are negatively associated with financial inclusion. The probable explanation of our result is that as remittance flow is a developing economies phenomenon, and it relaxes the credit constraints of the individual, it is unlikely that remittance flow will enhance financial inclusion for the entire sample.[129] In addition, government-owned banks are less efficient in their outreach of financial services than privately owned (foreign) ones; therefore it will have minimal impact (zero impact) on extending access to finance. However, we test the relevance and validity of our IVs used in this study. The first stage regression of the instruments on financial inclusion suggests

[129] We find financial inclusion is positively associated with remittance flow for a sample of developing countries. The contrasting result is due to the fact that most developing economies receive the lion share of remittance relative to GDP compared to developed ones, which ultimately channel through the formal financial system, and hence enhance financial inclusion.

these instruments are strong, with the average *F*-stats well above the conventional threshold ($F \geq 10$), demonstrating the relevance of the instrumental variables (Staiger and Stock, 1997).

The second-stage regression results are reported in Table 5.7. The reported values of the Wald (χ^2) tests statistic for exogeneity indicate the financial inclusion variable can be considered as endogenous and therefore instrumenting is appropriate. We also conduct the Anderson-Rubin test of under-identification, and find that the null hypothesis of weak instruments is rejected at a 1% significance level in all cases. The over-identification test proxied by the Amemiya–Lee–Newey minimum χ^2 test shows that the selected group of instruments is valid as the null hypothesis cannot be rejected at the 5% significance level. The results show the robustness of our findings in controlling for endogeneity and simultaneity biases. We find strong and consistent evidence that greater financial inclusion is associated with high levels of cost and profit efficiency in banks. Table 5.B2 also confirms our earlier interactive effects of financial inclusion with bank competition and institutional quality on bank efficiency using IV Tobit regressions.

5.4.2 Alternative bank efficiency measure

So far we find a robust link between financial inclusion and bank efficiency. However, it is possible that this relation could be due to poorly specified cost and profit functions. Columns 5-8 of Table 5.7 also reports robustness checks that we performed due to addressing concerns related to cost and profit frontier estimation. In this case, we estimated cost and profit efficiency by using time-varying inefficiency specifications of Battese and Coelli (1992). The results also confirm our earlier findings that financial inclusion has positive and significant effects on the cost and profit efficiency of banks.

5.4.3 Alternative financial inclusion index

Given the limitations of data availability, we try to incorporate as many

dimensions as possible in the construction of a financial inclusion index. However, it might be the case that the inadequate measure of financial inclusion has provided an incorrect inference in this study. Therefore, we use Global Findex Database to examine whether our main results hold. The most common variables that are used as the proxy for financial inclusion in recent studies (see e.g., Demirgüç-Kunt, Klapper and Singer, 2013; Allen, Carletti, Cull, Senbet and Valenzuela, 2014) are *Adults with an account at a formal financial institution to total adults* (%) and *Adults saving at a financial institution in the past year to total adults* (%). Since this database is new and just covers the calendar year 2011, we collapse our dataset at bank-level to run pooled cross-sectional Tobit regressions. The regression results are reported in Table 5.8. We run eight different regressions and the results are highly significant and consistent with the earlier findings that financial inclusion (i.e., the percentage of adults with account/savings in a formal financial system) is positively associated with bank cost and profit efficiency. It stresses the point that greater financial inclusion is congenial for efficient financial intermediation of banks both in terms of cost and profit.

5.4.4 Split samples based on financial inclusion

Based on the financial inclusion index, we split our sample into terciles and re-run six Tobit regressions.[130] For the sake of expositional simplicity, efficiency-adjusted Lerner index is used as a measure of bank competition in all cases. The results are reported in Table 5.9 (column 1-6). In columns 1-3, we find that all three groups of financial inclusion (low, medium, and high) are positively and significantly associated with bank cost efficiency. As we move from low to high groups of financial inclusion, we see that the magnitude of the coefficients of financial inclusion as well as the levels of significance

[130] Summary statistics: the group with the lowest financial inclusion index (FII) has an average cost (profit) efficiency of 71% (51%), the group with a medium FII has an average cost (profit) of 78% (58%), and the group with the highest FII has an average cost (profit) of 95% (58%).

increase. The twofold increases of the magnitude of coefficients of financial inclusion from low to high groups are an indication of the importance of greater financial inclusion on bank cost efficiency. In columns 4-6, while a lower level of financial inclusion is not statistically significant, medium terciles of financial inclusion are positively and significantly associated with bank profit efficiency. Interestingly, the negative coefficient of high terciles of financial inclusion indicates that greater financial inclusion decreases the level of profit efficiency.

5.4.5 Different sample selection and weighted Tobit regressions

We also conduct a battery of sensitivity checks using different sample selection criteria such as excluding cooperative and Islamic banks, excluding Japan and Italy, and keeping only developing countries. Our dataset comprises 1549 commercial banks, 1084 cooperative banks and 37 Islamic banks. We drop all cooperative and Islamic banks from our dataset and keep only commercial banks. The result of the regressions, which is reported in Table 5.9 (column 7 and 8), also confirms our earlier findings of the positive effects of financial inclusion on bank cost and profit efficiency. The number of banks in Japan and Italy is 457 and 489 respectively, which constitute the lion's share of our sample. We drop these two countries and re-run regressions, which are reported in Table 5.9 (columns 9 and 10). Dropping Japan and Italy does not alter the main findings of this study. In columns 11 and 12, we drop all developed countries from our sample and re-run Tobit regression using only developing countries.[131] The magnitude of the coefficients of financial inclusion suggests that the impacts of an inclusive financial system on cost and profit efficiency for the banks operating in developing economies are much higher than

[131] The 27 countries we dropped are: Austria, Bahamas, Belgium, Croatia, Cyprus, Estonia, Finland, Greece, Hong Kong, Hungary, Iceland, Ireland, Italy, Japan, Korea, Kuwait, Malta, Netherlands, Norway, Portugal, Saudi Arabia, Singapore, Spain, Switzerland, Trinidad and Tobago, United Arab Emirates, United Kingdom.

the banks in developed ones. Furthermore, it might be the case that our results are biased to business cycle and too-big-to-fail banks. First, given the global financial crisis, we have therefore averaged all variables over 2004-2012 to eradicate any period cyclicality and run Tobit regression at the bank level similar to Houston, Lin, Lin and Ma (2010). One advantage of this procedure is that it smoothes variables that vary over time (Demirgüç-Kunt, Laeven and Levine, 2004). Second, to avoid any effects of the heterogeneous bank size, we use total assets of individual banks as Weights and run weighted Tobit regressions. The results are reported in Table 5.10. Even after controlling for all these, we find significant positive effects of financial inclusion on bank cost and profit efficiency.

5.4.6 Exploiting country- and bank-specific heterogeneity

Since sample heterogeneity of different economies is inherent in any cross-country study, we choose to include country dummies with year fixed effect to ensure that any country-level fixed effects have not been inadvertently captured by our country-level variable of interest-*financial inclusion*. The results are reported in Table 5.11. According to columns 1-4, while financial inclusion is significantly associated with cost efficiency it shows an insignificant association with bank profit efficiency. However, the coefficient remains positive.

So far, we estimate the pooled cross-sectional Tobit model assuming there is no bank-specific heterogeneity. In columns 5-8, we control for bank unobserved heterogeneity by using random effects Tobit model. Random effects Tobit model is employed as panel Tobit estimates with fixed effects tend to be biased (Greene, 2004). The consistency of the random effects Tobit model requires the strict exogeneity assumption, that is, the error term has to be uncorrelated with the covariates across all time periods, as well as the unobserved bank-level heterogeneity being uncorrelated with all covariates (Czarnitzki and Toole,

2011). However, the reported likelihood-ratio test indicates that unobserved heterogeneity plays an important role in depicting the relationship between financial inclusion and bank efficiency. The estimation results of the random effect model also corroborate with the pooled estimations that financial inclusion is positively associated with bank cost and profit efficiency. Particularly, while the magnitude of the coefficient of financial inclusion on cost efficiency slightly wanes, it remains largely unchanged for profit efficiency. In terms of economic significance, it shows that one standard deviation increase in the financial inclusion index will lead to a 4% and 3% increase in bank cost and profit efficiency, respectively.

5.5 The causal effects of enabling inclusive financial environment and bank efficiency: a 'Quasi-natural experiment'

In this section, we exploit the timing variations of the countries that become members of the network of financial inclusion policymakers, that is, the Alliance for Financial Inclusion (henceforth AFI), and identify the causal effects of enabling an inclusive environment on bank efficiency while using a 'Quasi-natural experiment' type difference-in-differences (DID) approach. To eliminate any sample selection bias and confounding in the treatment effects, we deploy a number of matching estimators including the recently developed bias-corrected covariate matching estimator proposed by Abadie and Imbens (2006).

In response to the global financial crisis that took place in 2008, the G20 leaders committed to reduce unbanked adult population in the world through improving the access of the low income groups to formal financial services at the Pittsburgh Summit in 2009. At the summit, the G20 principles for innovative financial inclusion (henceforth GPIFI) were drafted by the three Financial Inclusion Experts Group including the Alliance for

Financial Inclusion (henceforth AFI), the Consultative Group to Assist the Poor (CGAP), and the World Bank's International Finance Corporation (IFC) (Soederberg, 2013). To invigorate GPIFI, the Maya Declaration was signed by 38 member countries at the third Global Policy Forum of the AFI held in Riviera Maya, Mexico in 2011 (see Table 4.D1 for detail on the GPIFI and the Maya Declaration). However, 30 countries in our sample had acknowledged the benefit of embracing low income groups with formal financial services and became members of AFI at different time periods after the first Global Policy Forum held in Nairobi in 2009 (see Table 4.D2 for membership timing across countries). Since through the AFI member countries could share knowledge on access policies, and could get financial assistance from the organisation, extending the access of the poor people to formal financial sectors became an important policy priority for these countries. Since then, these countries have taken many initiatives for providing supportive laws and regulations for inclusive financial sectors.[132]

We assume that the pro-access policies that have been developed and implemented in those member countries had an obvious effect on the efficient functioning of banks. With the changing environment banks may have designed and adopted innovative, affordable and low-cost financial delivery models for providing services to low income groups. Therefore, we apply a difference-in-differences approach and explore whether the cost and profit efficiency of banks that operate in those countries increased or decreased due to enabling inclusive financial policies as follows:

$$Bank\ efficiency_{ijt} = \alpha_0 + \alpha_j + \alpha_t + \gamma(Financial\ Access\ Policy)_{jt\text{-}1} + \beta_1 BC_{ijt} + \beta_2 KC_{jt} + \varepsilon_{ijt} \quad (7.7)$$

[132] Member countries that took various supportive laws and regulations to broaden financial inclusion over time are summarised in the AFI's Working Groups Annual Report 2014, and can be accessed through the link below:
http://www.afi-global.org/sites/default/files/publications/afi_wg_report_2014_revise.pdf

where i indexes bank, j indexes countries, and t indexes years. $Bank\ efficiency_{ijt}$ is either *Cost* or *Profit efficiency* of banks. The country and year fixed effects are denoted as α_j and α_t, respectively (we also use bank fixed effects as a robustness test in Table 5.12). The analogous bank- and country-level controls are used as in equation (5.4) denoted by BC_{ijt} and KC_{jt}, respectively.[133] $Financial\ Access\ Policy_{jt-1}$ is an indicator variable that takes a value equal to one if a bank operates in any member country listed in Table 4.D2 that became a member of AFI's network in 2009 and thereafter or else zero. The variable of interest is γ, and it captures the sensitivity of the dependent variable to the changes in the Pro-access policies.[134] Notice that we use 1-year lag membership variable assuming that the beneficial effects of financial inclusion are a year-end status. The advantage of the DID approach is that we are able to identify the causal effects of an event (in our case, the membership of AFI) on groups that are affected by the institutional settings (henceforth treated) with those that are not affected (henceforth control).[135] Since we are controlling both groups before and after the events and the same group is acting as control and treated in this methodology, we are able to control for both observables and unobservable factors that may have changed over time as well. With this approach, we can capture the treatment effect by eliminating the effects of the other changes that could have affected the treated group (Imbens and Wooldridge, 2009). The studies that apply this approach are Koetter, Kolari and Spierdijk (2012) on cross-state setup for the US banking sector and Haselmann, Pistor and Vig (2010) on cross-country setup for East European countries.

[133] We use lagged values of E-Lerner as the measure of bank competition due to alleviating reverse causality.

[134] For details on this methodology see Haselmann, Pistor and Vig (2010).

[135] To consider the DID approach is meaningful; there are two aspects that should be accounted for namely homogeneous comparison groups and the changes in the efforts of improving financial inclusion should be exogenous. The first issue has minimal effect on our analysis as most of the members are from developing countries (propensity score matching is employed for having valid counterfactuals in the latter analysis). Regarding the second issue, whether change of efforts of improving financial inclusion is exogenous or endogenous, it is an important concern. Since policy initiatives and innovative principles of financial inclusion were thrust upon by G20, expert groups on financial inclusion e.g., AFI and World Bank, it shows the exogenous nature and randomness in embracing innovative policy suggestions.

Table 5.12 reports the results of the DID estimation. It shows that bank efficiency has increased following participation in the network of AFI. Particularly, while we control for country fixed effects in columns 1-2, we consider bank fixed effects in columns 3-4. In all specifications, we use the analogous bank- and country-specific controls with year fixed effects. It can be seen from column 1 that the coefficient on the *Financial Access Policy* indicator is positive and highly significant with bank cost efficiency. A similar result can be observed with profit efficiency. We can also see that even controlling for bank fixed effects in columns 3-4 it does not change our results for any of the efficiency measures. The probable reason for such results is that member country regulatory institutions could develop and implement more effective policies designed to broaden access for the poor under the auspices of AFI which played an important role in the observed bank efficiency pickup. It also indicates that increasing financial inclusion reduces average costs of intermediation by increasing the levels of cost and profit efficiency of banks. This result is also consistent with the existing evidence suggesting that with favourable institutional settings, banks are better able to exploit economies of scale and operate efficiently (see Jayaratne and Strahan, 1996).

Our analysis focuses on the comparison of countries that are members of AFI with non-member ones in terms of efficiency of the financial intermediation. To this end, we employ a placebo test to examine whether these treated countries have similar effects on bank efficiency if we construct a pseudo indicator assuming that these countries had joined the AFI network three years prior to the timing reported in Table 4.D2. In this case, if indeed the earlier positive effects of the AFI network on bank efficiency were to be true we would expect no significant positive effects between placebo AFI indicator and bank efficiency. The results are presented in columns 5-8 of table 5.12. They show a significant

negative coefficient for cost efficiency and insignificant positive relationship with profit efficiency. This reaffirms our argument that increasing financial inclusion is positively associated with bank efficiency.

So far we use bank/country fixed effects to control for bank—and country—level unobservables along with time-varying industry-level unobservables. It does not guarantee that our comparison group is appropriately handled for our analysis. This limitation can be alleviated effectively using matching estimators where treated and control groups will be selected based on their observable characteristics (Rosenbaum and Rubin, 1983). In that vein, we use the non-parametric difference-in-differences propensity score matching approach to identify the causal effect of the AFI network on bank efficiency. Combining matching estimators with difference-in-differences technique is arguably the most appropriate approach making a causal claim while alleviating any selection bias that ascertain a valid control group as counterfactual (Blundell and Costa Dias, 2000).

In the first stage of propensity score matching (PSM), we estimate the likelihood of countries being treated (becoming a member of the AFI network in the present context) by using a logit model employing country- and industry-specific characteristics (see Table 5.C1). In the second stage, we match each member country of AFI with non-member countries with a similar propensity score.[136] For this procedure, we consider two matching techniques including kernel marching and stratification matching to calculate the average treatment effect for the treated (ATT).[137] Additionally, we employ a covariate matching estimator (henceforth Abadie and Imbens) following the recent development in the microeconometric evaluation studies (Abadie and Imbens, 2006). In this case, we follow

[136] The balancing tests are satisfied and reported in Table 5.C1. Figure 5.C1 shows the propensity score matching blocks.

[137] While kernel matching estimator matches the treated units with weighted average of all control units, with weights that are inversely proportional to the distance in terms of their propensity score, stratification matching estimator divides the common support into different strata and measures the treatment's effect within each interval. For details on the matching methods see Lin and Ye (2007) and De Mendonça and De Souza (2012).

Abadie, Drukker, Herr and Imbens (2004) and measure ATT matching on the four nearest neighbours. Unlike PSM, the Abadie and Imbens method employs covariates to match the treatment group and control group.[138] It also corrects for bias when matching is not perfect, and provides heteroskedasticity robust standard errors for the matching estimators while making no assumption about the functional form.

The results are reported in Panel B of Table 5.12, and they are consistent with the earlier findings. The result provides the causal effects of the *Financial Access Policy* on bank efficiency. In all matching estimators, we impose a common support condition to restrict control groups to fall within the support of the propensity score distribution of the treated groups. The estimates show that the average treatment effect of the *Financial Access Policy* on bank cost efficiency is 0.06, while it is 0.04 on profit efficiency (averaged across estimators). However, for the latter case, Abadie and Imbens' method shows positive but insignificant ATT effects. These results once again reaffirm our hypothesis that financial inclusion is good for bank efficiency.

5.6 Conclusions and policy implications

This paper investigates the association of an inclusive financial sector with bank efficiency using 2913 banks from 87 countries for the period 2004-2012. We find strong evidence that banks in countries with a greater inclusive banking sector tend to have higher levels of cost and profit efficiency. This effect is particularly strong for banks with higher market power and banks that operate in an environment where the overall institutional qualities are greater. Furthermore, we also exploit the exogenous timing variations of the developing countries that participate in a network of financial inclusion policymakers, and

[138] In Abadie and Imbens, the following pre-treatment characteristics are used as covariates for matching: industry average total asset, GDP per capita, GDP growth rate, financial freedom, regulatory quality, and a dummy that takes one for developing countries or else zero.

explore the causal effects of a supporting inclusive environment on bank efficiency. This underscores the importance of a conducive inclusive environment in broadening the access to finance and its complementary effects on the efficient intermediation of financial institutions.

The results are robust to alternative measures of financial inclusion, bank efficiency, to keeping only commercial banks and developing countries, to employing IV analysis, to controlling for country- and bank unobserved heterogeneity, and finally, to exploring the effects of a network of financial inclusion policymakers, which sets the stage for many enabling laws in the member countries to broaden the access of the poor people to financial services. For all of these alternative setups, we show that the efficiency of the banks has increased after the expansion of the financial inclusion. Our findings suggest that a financial system that provides easier access to finance increases efficiency in the financial intermediation of the banks, and hence makes them more efficient, both in terms of cost and profit. They also show that financial inclusion is an important policy lever to bring more people into the formal economy, and concurrently set an environment for efficient financial operation.

These results are novel in the literature. While previous papers show the effect of financial inclusion on various socio-economic indicators (e.g., Butler and Cornaggia, 2011; Allen, Carletti, Cull, Qian, Senbet and Valenzuela, 2013; Demirgüç-Kunt, Klapper and Singer, 2013), this paper is the first to show the explicit link between a key ingredient of financial development strategy and cross-bank and cross-country variation in the levels of bank efficiency, a topic that deserves more theoretical and empirical attention for establishing a robust link between these variables. While previous studies focus on the relationship between bank branch penetration and a firm's tax avoidance (see Beck, Lin and Ma, 2014), or a firm's financing obstacle (see Beck, Demirgüç-Kunt and Martínez Pería, 2007), this is the first paper to relate cross-country variation in an inclusive banking

sector to the operating efficiency of the financial institutions, and to simultaneously contribute to the bank efficiency literature.

The policy implications of our results are great. Since the larger the banking population the higher the bank efficiency, both in terms of cost and profit, policymakers should introduce more policies that are conducive for access to finance aiming at ensuring efficient financial intermediation. Furthermore, our results also stress the importance of the underlying competitive and institutional framework. The beneficial effects of financial inclusion on bank cost (profit) efficiency are more (less) in the countries where competition of banks is high (low). In this respect, regulators should pay adequate attention to balancing this moderating effect of bank competition on the nexus between financial inclusion and cost/profit efficiency. They should continuously make efforts to provide an environment that would be conducive for increasing financial inclusion and hence bank efficiency.

We see this paper as a first attempt to find the link between financial inclusion and bank efficiency. As more data, both supplier and demand-side, become available, other dimensions of financial inclusion can be incorporated into the construction of the composite index so as to explore the relationship between an inclusive financial sector and bank efficiency.

Table 5.1

Variable Definitions and Sources

Variable	Definitions	Source
Dependent Variables		
Cost efficiency	Cost efficiency has been estimated using stochastic frontier model proposed by Greene (2005) with the range between 0 and 1	Authors' calculation
Profit efficiency	Alternative profit efficiency has been estimated using stochastic frontier model proposed by Greene (2005) with the range between 0 and 1	Authors' calculation
Financial		
Penetration	The number of deposit and loan accounts per 1000 adults	IMF FAS
Availability	The outreach dimension constructed using principal component analysis (PCA) from the variables related to geographic and demographic availability of branches and ATMs	Authors' calculation
Usage	Total volume of deposit and loans relative to GDP	IMF FAS
Financial inclusion index	Financial inclusion index is constructed using principal component analysis from the penetration, availability and usage dimensions.	Authors' calculation
Bank competition		
C-Lerner	A bank-level non-structural indicator of bank competition, measured by using a stochastic frontier analysis approach assuming full bank efficiency, with lower values indicating higher competition in the banking sector	Authors' calculation
E-Lerner	A bank-level non-structural indicator of bank competition, an efficiency-adjusted Lerner index, measured by using a stochastic frontier analysis approach, with lower values indicating higher competition in the banking sector	Authors' calculation
Bank-specific variables		
Loan ratio	Total performing loans divided by total assets	BankScope
LLP ratio	Total loan loss provision divided by total assets	BankScope
Income diversification	Non-interest income divided by total operating income	BankScope
Management	Total earning assets divided by total assets	BankScope
Equity ratio	Total equity divided by total assets	BankScope
IV Instruments		
Remittance	Remittance inflows to GDP (%) from Global Financial Development Database	World Bank
Government bank ownership	The extent to which the banking system's assets are government owned	Barth, Caprio, and Levine (2013)
Monetary freedom	Weighted average of the extent of price controls and current and two-period lagged inflation rate to combine the measure of price stability.	Heritage Foundation (2014)
Entry density	Entry density is a variable referring to the number of newly registered companies with limited liability per 1,000 working-age people (those aged 15-64).	Doing Business database
Macroeconomic variables		
GDP growth rate	The growth rate of GDP	World Bank
GDP per capita	The natural logarithm of per capita GDP	World Bank
Voice and accountability (Voice)	The indicator measures the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and free media. Higher values mean greater political rights	Kaufmann, Kraay and Mastruzzi (2010)
Political stability (Political)	The indicator measures the perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including political violence and terrorism. Higher values mean more stable political environment	Kaufmann, Kraay and Mastruzzi (2010)
Government effectiveness (Government)	The indicator measures the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. Higher values mean higher quality of public and civil service	Kaufmann, Kraay and Mastruzzi (2010)
Regulatory quality (Regulatory)	The indicator measures the ability of the government to formulate and implement sound policies and regulations that permit and promote market competition and private-sector development. Higher values mean higher quality of regulation	Kaufmann, Kraay and Mastruzzi (2010)
Rule of law (Law)	The indicator measures the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, the police, and the courts, as well as the likelihood of crime and violence. Higher values mean stronger law and order.	Kaufmann, Kraay and Mastruzzi (2010)
Control of corruption (Corruption)	The indicator measures the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as ''capture'' the state by elites and private interests. Higher values indicate better control of corruption.	Kaufmann, Kraay and Mastruzzi (2010)
Institutional quality index (IQI)	Institutional quality index is constructed using principal component analysis from the Voice, Political, Government, Regulatory, Law, and Corruption indexes of Kaufmann, Kraay and Mastruzzi (2010)	Authors' calculation

Table 5.2A

Summary Statistics

This table shows the total sample summary statistics for the bank-specific variables, macroeconomic variables and the variables that are used as instruments in the instrumental variable regressions throughout the paper. Detailed definitions and the sources of the variables are provided in Table 5.1. The full sample contains 14929 observations. This table consists of six parts. The descriptive statistics of the dependent variables which are used to proxy for cost and profit efficiency of individual banks are in the first part. The financial inclusion index and its three dimensions are in the second part of this table. The third part contains two variant measures of bank competition, which is proxied by two variants of Lerner indices: conventional Lerner (i.e., C-Lerner) and efficiency-adjusted Lerner (i.e., E-Lerner). Bank-specific variables are in the fourth part. IV instruments are in the fifth part of this table followed by the macroeconomic variables in the sixth.

	Mean	Median	SD	Min	Max	N
Dependent Variables						
Cost efficiency	0.81	0.95	0.29	0.00	1.00	14929
Profit efficiency	0.56	0.58	0.32	0.00	1.00	14929
Financial Inclusion						
Financial inclusion index	0.56	0.59	0.29	0.00	1.00	14929
Penetration	0.49	0.35	0.35	0.00	1.00	14929
Availability	0.62	0.79	0.34	0.00	1.00	14929
Usage	0.11	0.00	0.22	0.00	1.00	14929
Bank competition measures						
C-Lerner	0.06	0.10	0.29	-1.39	0.80	14929
E-Lerner	0.14	0.16	0.25	-0.75	0.88	14929
Bank-specific variables						
Loan ratio	0.56	0.57	0.19	0.00	1.00	14929
Total assets	7.08	6.90	1.94	-2.03	14.91	14929
LLP ratio	0.01	0.01	0.04	-0.29	2.69	14929
Income diversification	0.17	0.14	0.77	-24.25	82.21	14929
Management quality	0.91	0.95	0.10	0.03	1.11	14929
Equity ratio	0.11	0.09	0.09	0.00	0.93	14929
IV Instruments						
remittance flow to GDP	1.79	0.32	4.05	0.00	34.50	14659
Government bank ownership	13.29	4.80	18.56	0.00	90.00	11236
Monetary freedom	80.31	80.70	8.31	40.30	94.30	14826
New firm entry density	2.68	1.91	3.73	0.03	39.00	12869
Macroeconomic variables						
GDP growth rate	2.10	1.90	4.00	-18.00	22.60	14929
log GDP per capita	9.50	10.28	1.36	4.97	11.12	14929
Voice and accountability (Voice)	0.67	0.95	0.71	-2.10	1.75	14929
Political stability (Political)	0.31	0.50	0.81	-2.81	1.49	14929
Government effectiveness (Government)	0.67	0.45	0.86	-1.50	2.43	14929
Regulatory quality (Regulatory)	0.71	0.95	0.73	-1.68	1.96	14929
Rule of law (Law)	0.59	0.44	0.91	-1.96	1.98	14929
Control of corruption (Corruption)	0.55	0.31	0.98	-1.64	2.27	14929
Institutional quality index (IQI)	-0.01	0.01	2.29	-7.03	3.75	14929

Table 5.2B
The estimation results for the bank efficiency and financial inclusion (country ranking in parentheses) Source: Author's calculation.

Country	Cost efficiency	Profit efficiency	Financial inclusio	No. of Ban	Country	Cost efficiency	Profit efficiency	Financial inclusio	No. of Ban
Asia									
Afghanistan	0.991	0.757	0.012	9	Norway	0.830	0.647	0.089	12
Armenia	0.932	0.645	0.224	14	Portugal	0.927	0.522	0.785	18
Azerbaijan	0.947	0.570	0.136	21	Serbia	0.949	0.553	0.385	28
Bangladesh	0.996	0.917	0.46	12	Spain	0.849	0.615	0.816	89
Cambodia	0.982	0.714	0.072	12	Switzerland	0.873	0.640	0.694	124
Cyprus	0.379	0.696	0.365	13	Ukraine	0.434	0.242	0.52	14
Georgia	0.128	0.098	0.285	12	United Kingdom	0.808	0.478	0.405	95
Hong Kong SAR,	0.895	0.655	0.389	28	*Average/Total*	*0.818*	*0.585*	*0.527*	*1266*
India	0.954	0.686	0.373	62	***Americas***				
Indonesia	0.932	0.680	0.233	61	Argentina	0.091	0.072	0.256	50
Japan	0.999	0.568	0.977	457	Bahamas, The	0.919	0.690	0.429	11
Jordan	0.010	0.010	0.272	12	Bolivia	0.968	0.836	0.083	10
Kazakhstan	0.107	0.084	0.304	27	Brazil	0.747	0.507	0.455	104
Korea, Rep.	0.753	0.734	0.991	14	Chile	0.388	0.460	0.622	24
Kuwait	0.974	0.577	0.292	12	Colombia	0.947	0.687	0.414	21
Lebanon	0.008	0.008	0.496	33	Costa Rica	0.217	0.209	0.362	42
Malaysia	0.816	0.839	0.48	14	Dominican	0.277	0.248	0.184	57
Mongolia	1.000	0.956	0.421	3	Ecuador	0.977	0.612	0.191	19
Pakistan	0.932	0.647	0.076	11	El Salvador	0.978	0.640	0.206	13
Philippines	0.045	0.045	0.116	22	Honduras	0.995	0.704	0.143	15
Saudi Arabia	0.997	0.663	0.271	12	Jamaica	0.965	0.997	0.343	5
Singapore	0.810	0.681	0.368	13	Nicaragua	0.680	0.918	0.081	5
Thailand	0.742	0.684	0.475	21	Panama	0.198	0.164	0.258	41
Turkey	0.938	0.688	0.524	27	Peru	0.340	0.099	0.24	15
United Arab	0.925	0.629	0.296	24	Trinidad and	0.050	0.050	0.345	9
Uzbekistan	0.044	0.044	0.138	9	Venezuela, RB	0.869	0.669	0.236	27
Yemen, Rep.	0.999	0.585	0.021	6	*Average/Total*	*0.624*	*0.504*	*0.285*	*468*
Average/Total	*0.712*	*0.550*	*0.336*	*961*	***Africa***				
Europe					Algeria	0.111	0.085	0.079	12
Austria	0.863	0.593	0.354	158	Angola	0.330	0.757	0.047	12
Belgium	0.820	0.533	0.981	27	Botswana	0.984	0.806	0.199	7
Bosnia and	0.973	0.544	0.312	19	Burundi	0.630	0.891	0.051	5
Bulgaria	0.964	0.618	0.711	17	Cameroon	0.969	0.654	0.033	8
Croatia	0.385	0.584	0.386	29	Egypt, Arab Rep.	0.001	0.001	0.102	21
Estonia	0.962	0.819	0.618	7	Ghana	0.975	0.711	0.059	17
Finland	0.866	0.692	0.542	10	Kenya	0.957	0.663	0.055	29
Greece	0.779	0.575	0.545	10	Libya	0.997	0.972	0.051	6
Hungary	0.931	0.585	0.417	22	Malawi	0.996	0.910	0.027	5
Iceland	0.016	0.000	0.206	5	Mauritius	0.954	0.721	0.557	12
Ireland	0.925	0.636	0.489	8	Mozambique	0.983	0.618	0.03	10
Italy	0.827	0.633	0.564	489	Namibia	0.699	0.693	0.231	6
Latvia	0.955	0.647	0.393	19	Rwanda	0.974	0.512	0.112	7
Macedonia, FYR	0.963	0.688	0.492	13	South Africa	0.853	0.683	0.182	14
Malta	0.949	0.744	0.921	7	Tanzania	0.985	0.617	0.034	21
Moldova	0.909	0.758	0.327	12	Uganda	0.982	0.534	0.044	14
Montenegro	0.883	0.674	0.386	7	Zambia	0.980	0.556	0.071	12
Netherlands	0.803	0.604	0.83 (5)	27	*Average/Total*	*0.798*	*0.632*	*0.109*	*218*

Table 5.3

The effect of financial inclusion on bank efficiency

We use pooled cross-sectional Tobit model where the dependent variable is the *Cost efficiency*, reported in columns 1-2, *Alternative profit efficiency* is reported in columns 3-4. *Financial Inclusion* is a composite index, constructed by using principal component analysis from three dimensions, namely Penetration, Availability, and Usage. Bank competition is proxied by two variants of the Lerner indices i.e., conventional Lerner (*C-Lerner*) and efficiency-adjusted Lerner (*E-Lerner*). *Loan ratio* is measured as loans as a percentage of total assets. *Bank size* is the logarithm of total assets valued in U.S. dollar (millions). *Loan loss provision* ratio is measured as a percentage of total assets, where income diversification is the ratio of non-interest income over total income. *The management quality* is measured as the total earning assets over total assets. *Capitalisation* is the bank total equity to asset ratio. To control for economic development, logarithm of *GDP per capita* is used, and *GDP growth rate* is used to account for condition of business cycle in each country. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Source: BankScope and WDI. Coverage: 2004-2012.

VARIABLES	**Cost efficiency**		**Profit efficiency**	
	1	2	3	4
Financial Inclusion	0.319***	0.314***	0.059***	0.061***
	[0.019]	[0.019]	[0.018]	[0.019]
Bank-specific characteristics				
Loan Ratio	0.030	0.025	0.092***	0.100***
	[0.026]	[0.025]	[0.023]	[0.022]
Bank Size	-0.005*	-0.005*	0.000	0.000
	[0.003]	[0.003]	[0.002]	[0.002]
Loan Loss Provision	0.058	0.049	-0.522***	-0.512***
	[0.068]	[0.066]	[0.200]	[0.195]
Income Diversification	0.005	0.005	0.007	0.007
	[0.004]	[0.004]	[0.009]	[0.009]
Management Quality	0.345***	0.340***	0.247***	0.252***
	[0.069]	[0.069]	[0.059]	[0.059]
Capitalisation	-0.169**	-0.147**	0.097*	0.075
	[0.066]	[0.067]	[0.055]	[0.055]
C-Lerner	-0.045***		0.064***	
	[0.016]		[0.014]	
E-Lerner		-0.052**		0.056***
		[0.023]		[0.019]
Country Macro-controls				
GDP Growth Rate	-1.283***	-1.265***	-0.761***	-0.782***
	[0.173]	[0.174]	[0.160]	[0.159]
Per Capita GDP	-0.035***	-0.034***	-0.011**	-0.012**
	[0.005]	[0.005]	[0.005]	[0.005]
Constant	0.645***	0.654***	0.347***	0.336***
	[0.074]	[0.075]	[0.063]	[0.063]
Observations	14,929	14,929	14,929	14,929
Pseudo R^2	0.576	0.574	0.0587	0.0553
F	60.11	61.21	8.533	7.491

Table 5.4

Interactive result of financial inclusion and bank competition on efficiency

We use pooled cross-sectional Tobit model where the dependent variable is the *Cost efficiency*, reported in columns 1-2, *Alternative profit efficiency* is reported in columns 3-4. *Financial Inclusion* is a composite index, constructed by using principal component analysis from three dimensions, namely Penetration, Availability, and Usage. Bank competition is proxied by two variants of the Lerner indices i.e., conventional Lerner (*C-Lerner*) and efficiency-adjusted Lerner (*E-Lerner*). The rest of the variables are analogous as in Table 5.3 except the interactions of financial inclusion and Lerner indices. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively.

Source: BankScope and WDI. Coverage: 2004-2012.

VARIABLES	**Cost efficiency**		**Profit efficiency**	
	1	2	3	4
Financial Inclusion	0.319***	0.319***	0.060***	0.055***
	[0.019]	[0.019]	[0.018]	[0.019]
Bank-specific characteristics				
Loan Ratio	0.029	0.03	0.085***	0.093***
	[0.026]	[0.025]	[0.023]	[0.022]
Bank Size	-0.005*	-0.005*	0	0
	[0.003]	[0.003]	[0.002]	[0.002]
Loan Loss Provision	0.058	0.054	-0.526***	-0.517***
	[0.068]	[0.065]	[0.201]	[0.195]
Income Diversification	0.005	0.005	0.007	0.007
	[0.004]	[0.004]	[0.008]	[0.009]
Management Quality	0.345***	0.345***	0.242***	0.247***
	[0.069]	[0.069]	[0.059]	[0.060]
Capitalisation	-0.170**	-0.131*	0.083	0.056
	[0.066]	[0.068]	[0.055]	[0.056]
C-Lerner	-0.05		0.007	
	[0.031]		[0.028]	
E-Lerner		0.001		-0.008
		[0.041]		[0.034]
Financial Inclusion x C-Lerner	0.01		0.124***	
	[0.044]		[0.044]	
Financial Inclusion x E-Lerner		-0.129**		0.154***
		[0.062]		[0.058]
Country Macro-controls				
GDP Growth Rate	-1.281***	-1.279***	-0.741***	-0.765***
	[0.174]	[0.175]	[0.159]	[0.160]
Per Capita GDP	-0.035***	-0.033***	-0.012**	-0.013***
	[0.005]	[0.005]	[0.005]	[0.005]
Constant	0.646***	0.632***	0.362***	0.363***
	[0.075]	[0.076]	[0.063]	[0.064]
Observations	14,929	14,929	14,929	14,929
Pseudo R^2	0.576	0.578	0.061	0.0574
F	62.33	74.96	9.439	7.829

Table 5.5

Financial inclusion and institutional quality interactions: Cost efficiency using Tobit

This table reports Tobit regressions of bank *cost efficiency* on *financial inclusion*, six measures of institutional quality and their interactions. The analogous bank and macro controls are used as in Table 5.3, except additional Governance Indicators and their interactions with financial inclusion. We use lagged values of efficiency adjusted Lerner index as the proxy for bank competition. Each interaction and its constituents are entered one at a time. For the sake of brevity, the results of the controls are not reported in this table but available upon request. The detailed definition and their sources are provided in Table 5.1. In column 7, we capture common variation among the six governance indicators using the principal component analysis and construct a composite index of *institutional quality (IQI)*, and re-run Tobit regression to gauge overall effect of institutional quality on the relationship between financial inclusion and *cost efficiency*.

	Dependent variable: Cost efficiency						
VARIABLES	1	2	3	4	5	6	7
Financial inclusion index (FII)	0.093**	0.220***	0.098**	0.058	0.116***	0.199***	0.220***
	[0.045]	[0.035]	[0.043]	[0.048]	[0.040]	[0.039]	[0.025]
Voice and accountability (Voice)	-0.019						
	[0.022]						
FII x Voice	0.254***						
	[0.045]						
Political stability (Political)		0.017					
		[0.023]					
FII x Political		0.144***					
		[0.037]					
Government effectiveness (Government)			0.02				
			[0.020]				
FII x Government			0.152***				
			[0.030]				
Regulatory quality (Regulatory)				-0.025			
				[0.024]			
FII x Regulatory				0.272***			
				[0.043]			
Rule of law (Law)					0.032*		
					[0.018]		
FII x Law					0.163***		
					[0.029]		
Control of corruption (Corruption)						0.061***	
						[0.019]	
FII x Corruption						0.072***	
						[0.027]	
Institutional quality index (IQI)							0.015*
							[0.008]
FII x IQI							0.065***
							[0.012]
Constant	0.887***	0.874***	0.953***	0.925***	1.074***	1.104***	1.137***
	[0.089]	[0.084]	[0.092]	[0.097]	[0.089]	[0.093]	[0.105]
Observations	14,929	14,929	14,929	14,929	14,929	14,929	14,929
Bank and Macro controls	√	√	√	√	√	√	√
Year dummies	√	√	√	√	√	√	√
Pseudo R^2	0.66	0.67	0.70	0.67	0.74	0.73	0.73
One SD above average	0.45	0.38	0.33	0.45	0.36	0.31	0.37
Marginal effect	0.27	0.26	0.20	0.25	0.21	0.24	0.22
Marginal effect: standard error	0.02	0.03	0.03	0.02	0.03	0.03	0.03
One SD below average	0.08	0.15	0.07	0.05	0.06	0.17	0.07

Table 5.6

Financial inclusion and institutional quality interactions: Profit efficiency using Tobit

This table reports Tobit regressions of bank *profit efficiency* on *financial inclusion*, six measures of institutional quality and their interactions. The analogous bank and macro controls are used as in Table 5.3, except additional Governance Indicators and their interactions with financial inclusion. We use lagged values of efficiency adjusted Lerner index as the proxy for bank competition. Each interaction and its constituents are entered one at a time. For the sake of brevity, the results of the controls are not reported in this table but available upon request. The detailed definition and their sources are provided in Table 5.1. In column 7, we capture common variation among the six governance indicators using the principal component analysis and construct a composite index of *institutional quality (IQI)*, and re-run Tobit regression to gauge the overall effect of institutional quality on the relationship between financial inclusion and *profit efficiency*.

	Dependent variable: Profit efficiency						
VARIABLES	1	2	3	4	5	6	7
Financial inclusion index (FII)	0.159***	0.057*	0.013	0.210***	0.004	0.048	0.03
	[0.046]	[0.030]	[0.039]	[0.054]	[0.037]	[0.036]	[0.024]
Voice and accountability (Voice)	0.113***						
	[0.021]						
FII x Voice	-0.101**						
	[0.041]						
Political stability (Political)		0.038**					
		[0.018]					
FII x Political		0.003					
		[0.031]					
Government effectiveness (Government)			0.017				
			[0.018]				
FII x Government			0.03				
			[0.027]				
Regulatory quality (Regulatory)				0.162***			
				[0.027]			
FII x Regulatory				-0.131***			
				[0.045]			
Rule of law (Law)					0.019		
					[0.016]		
FII x Law					0.045*		
					[0.027]		
Control of corruption (Corruption)						0.035**	
						[0.017]	
FII x Corruption						-0.001	
						[0.025]	
Institutional quality index (IQI)							0.01
							[0.007]
FII x IQI							0.019*
							[0.011]
Constant	0.504***	0.487***	0.454***	0.679***	0.506***	0.520***	0.562***
	[0.090]	[0.073]	[0.080]	[0.105]	[0.080]	[0.082]	[0.091]
Observations	12,869	14,929	14,929	12,869	14,929	14,929	14,929
Bank and Macro controls	√	√	√	√	√	√	√
Year dummies	√	√	√	√	√	√	√
Pseudo R^2	0.12	0.06	0.06	0.12	0.06	0.06	0.07
One SD above average	0.02	0.06	0.06	0.02	0.07	0.05	0.07
Marginal effect	0.09	0.06	0.03	0.12	0.03	0.05	0.03
Marginal effect: standard error	0.02	0.02	0.02	0.03	0.02	0.02	0.02
One SD below average	0.16	0.06	0.01	0.21	-0.01	0.05	-0.01

Table 5.7

The effect of financial inclusion on bank efficiency (plus BC efficiency measure) using IV-Tobit

This table reports the results of instrumental variables regressions of IV-Tobit regression using Newey's minimum chi-squared two step estimator. The results of the First-stage regressions are presented in the Appendix Table C5.1. The under-identification and over-identification results of the Anderson-Rubin test and the Amemiya–Lee–Newey minimum χ^2 test are reported at the bottom of the table, respectively. In columns 1-4, the dependent variable cost and profit efficiency are measured by using True fixed effects stochastic frontier analysis of Greene (2005), while in column 5-8, it is derived from time-varying inefficiency specifications of Battese and Coelli (1992). All other variables are analogous.

	Greene (2005)				**Battese and Coelli (1992)**			
VARIABLES	**Cost efficiency**		**Profit efficiency**		**Cost efficiency**		**Profit efficiency**	
	1	2	3	4	5	6	7	8
Financial inclusion	2.300***	2.296***	2.182***	2.050***	0.102***	0.072***	0.136***	0.187***
	[0.512]	[0.485]	[0.558]	[0.509]	[0.008]	[0.008]	[0.027]	[0.031]
Bank-specific characteristics								
Loan Ratio	0.002	0.001	0.032	0.045*	-0.007*	-0.002	-0.038***	0.013
	[0.023]	[0.023]	[0.025]	[0.024]	[0.004]	[0.004]	[0.013]	[0.013]
Bank Size	-0.036***	-0.036***	-0.031***	-0.029***	-0.009***	-0.008***	-0.002**	-0.002
	[0.007]	[0.007]	[0.008]	[0.007]	[0.000]	[0.000]	[0.001]	[0.001]
Loan Loss Provision	-0.037	-0.031	-0.568***	-0.550***	-0.068***	-0.080***	-0.418***	-0.404***
	[0.100]	[0.100]	[0.109]	[0.105]	[0.019]	[0.019]	[0.055]	[0.056]
Income Diversification	0.266***	0.261***	0.277***	0.262***	0.001	0.002***	0.002	0.005**
	[0.054]	[0.050]	[0.059]	[0.053]	[0.001]	[0.001]	[0.003]	[0.003]
Management Quality	0.098	0.101	-0.052	-0.008	0.009	0.001	0.079***	0.049*
	[0.093]	[0.087]	[0.101]	[0.091]	[0.009]	[0.009]	[0.028]	[0.029]
Capitalisation	-0.478***	-0.487***	-0.230***	-0.271***	-0.210***	-0.175***	-0.025	0.047
	[0.065]	[0.069]	[0.071]	[0.073]	[0.010]	[0.009]	[0.030]	[0.030]
C-Lerner	-0.005		0.116***		0.032***		0.152***	
	[0.019]		[0.020]		[0.003]		[0.008]	
E-Lerner		0.028		0.142***		-0.067***		-0.005
		[0.029]		[0.031]		[0.003]		[0.012]
Country Macro-controls								
GDP Growth Rate	1.061	1.037	1.693**	1.440**	-0.143***	-0.145***	0.303***	0.430***
	[0.696]	[0.648]	[0.757]	[0.680]	[0.030]	[0.029]	[0.095]	[0.097]
Per Capita GDP	-0.232***	-0.232***	-0.216***	-0.205***	-0.007***	-0.005***	-0.035***	-0.040***
	[0.046]	[0.044]	[0.051]	[0.046]	[0.001]	[0.001]	[0.004]	[0.004]
Constant	1.853***	1.847***	1.649***	1.544***	1.049***	1.056***	0.787***	0.796***
	[0.281]	[0.262]	[0.306]	[0.275]	[0.011]	[0.011]	[0.034]	[0.034]
Observations	11,165	11,165	11,165	11,165	14,575	14,575	12,869	12,869
Wald χ^2 test: exogeneity	40.84	45.47	31.02	30.16	128.7	116.5	13.97	45.26
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Under-identification test (p-value)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Over-identification test (p-value)	0.16	0.09	0.54	0.28	0.64	0.53	0.34	0.10

Table 5.8

The effect of global financial inclusion on bank efficiency

In this table we use Global Financial Inclusion Index (Global Findex) based on the World Bank. Since this measure is only available for the year 2011, we had to collapse our dataset at bank-level to run cross-sectional Tobit regression. The definitions of the rest of the variables are the same as Table 5.3. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Source: BankScope and World Bank.

	Adults with an account at a formal financial institution to total adults (%)				**Adults saving at a financial institution in the past year to total**			
	Cost efficiency		Profit efficiency		Cost efficiency		Profit efficiency	
VARIABLES	1	2	3	4	5	6	7	8
Global financial inclusion	0.006***	0.006***	0.003**	0.003**				
	[0.002]	[0.002]	[0.001]	[0.001]				
Global financial inclusion					0.008***	0.008***	0.003**	0.003**
					[0.002]	[0.002]	[0.001]	[0.001]
Bank-specific characteristics								
Loan Ratio	0.007	0.004	0.073	0.087	0.122	0.118	0.091	0.101
	[0.129]	[0.125]	[0.087]	[0.084]	[0.123]	[0.118]	[0.090]	[0.086]
Bank Size	-0.002	-0.003	0	0.001	-0.003	-0.004	-0.004	-0.003
	[0.009]	[0.010]	[0.007]	[0.008]	[0.010]	[0.010]	[0.007]	[0.007]
Loan Loss Provision	-0.033	-0.039	-0.264	-0.267	0.191	0.185	-0.13	-0.128
	[0.172]	[0.172]	[0.182]	[0.183]	[0.239]	[0.238]	[0.158]	[0.160]
Income Diversification	0.012	0.012	0.026	0.031*	-0.001	-0.001	0.014	0.016
	[0.026]	[0.025]	[0.017]	[0.019]	[0.020]	[0.020]	[0.014]	[0.014]
Management Quality	0.642**	0.631**	0.362**	0.378**	0.419*	0.411*	0.305*	0.317*
	[0.288]	[0.285]	[0.184]	[0.186]	[0.248]	[0.247]	[0.184]	[0.185]
Capitalisation	-0.194	-0.154	0.052	0.01	0	0.023	0.115	0.084
	[0.169]	[0.195]	[0.111]	[0.131]	[0.148]	[0.170]	[0.103]	[0.117]
C-Lerner	-0.042		0.099*		-0.036		0.069	
	[0.080]		[0.051]		[0.071]		[0.049]	
E-Lerner		-0.068		0.082		-0.05		0.069
		[0.112]		[0.064]		[0.102]		[0.064]
Country Macro-controls								
GDP Growth Rate	-2.339*	-2.283	-1.731*	-1.791*	-4.189***	-4.138***	-2.274**	-2.320**
	[1.362]	[1.396]	[1.036]	[1.056]	[1.242]	[1.285]	[1.018]	[1.037]
Per Capita GDP	-0.133***	-0.133***	-0.084***	-0.082***	-0.106***	-0.105***	-0.055**	-0.055*
	[0.045]	[0.045]	[0.030]	[0.030]	[0.035]	[0.035]	[0.028]	[0.028]
Constant	1.115***	1.131***	0.758***	0.716***	1.231***	1.241***	0.708***	0.686***
	[0.400]	[0.391]	[0.227]	[0.223]	[0.321]	[0.313]	[0.238]	[0.235]
Observations	2,192	2,192	2,192	2,192	2,497	2,497	2,497	2,497
Pseudo R^2	0.87	0.87	-1.05	-0.99	0.78	0.79	13.58	13.24
Countries	76	76	76	76	78	78	78	78

Table 5.9

Financial inclusion and bank efficiency: robustness checks

This table reports robustness tests of financial inclusion and bank efficiency. In the first six columns, we split the sample into three terciles based on financial inclusion and re-run Tobit regressions. In columns 7 and 8, we dropped observations of the cooperative and Islamic banks keeping only commercial banks. In columns 9 and 10, we dropped observations of Japan and Italy as they comprise lion shares of our sample and re-run regressions. In the last two columns, we dropped developed countries and re-run regression on the sample of developing countries only. The analogous bank and macro controls are used as in Table 5.3. We use lagged values of efficiency adjusted Lerner index as the proxy for bank competition.

	Lower terciles of financial	Medium terciles of financial	Higher terciles of financial inclusion	Lower terciles of financial	Medium terciles of financial inclusion	Higher terciles of financial	Only Commercial banks: Cooperative and Islamic banks excluded		Rest of the sample: Japan and Italy excluded		Only Developing Countries: Developed Countries excluded	
	Cost efficiency (CE)			Profit efficiency (PE)			CE	PE	CE	PE	CE	PE
VARIABLES	1	2	3	4	5	6	7	8	9	10	11	12
Financial inclusion	0.193*	0.215**	0.382***	-0.001	0.316***	-0.181**	0.209***	0.109***	0.159***	0.126***	0.550***	0.348***
	[0.111]	[0.098]	[0.043]	[0.098]	[0.089]	[0.072]	[0.040]	[0.036]	[0.034]	[0.030]	[0.075]	[0.064]
Bank-level controls												
Loan Ratio	0.054	0.166***	-0.008	-0.021	0.144***	0.078**	0.153***	0.131***	0.114***	0.098***	0.212***	0.138***
	[0.053]	[0.046]	[0.019]	[0.044]	[0.040]	[0.034]	[0.038]	[0.032]	[0.037]	[0.031]	[0.064]	[0.050]
Bank Size	-0.007	0.007**	-0.015***	0.003	0.003	-0.001	-0.005	0.001	-0.002	0.002	-0.005	0.004
	[0.006]	[0.003]	[0.005]	[0.005]	[0.003]	[0.004]	[0.004]	[0.004]	[0.004]	[0.003]	[0.006]	[0.005]
Loan Loss Provision	0.071	0.454**	-0.023	-0.565**	-0.672***	-0.468*	0.042	-0.366***	0.084	-0.366***	0.545***	-0.08
	[0.187]	[0.208]	[0.036]	[0.245]	[0.252]	[0.266]	[0.064]	[0.135]	[0.066]	[0.128]	[0.182]	[0.173]
Income Diversification	0.150***	0.063	0	0.143***	0.077***	0	0.155***	0.132***	0.105**	0.084***	0.145***	0.124***
	[0.049]	[0.056]	[0.000]	[0.043]	[0.029]	[0.003]	[0.029]	[0.027]	[0.043]	[0.028]	[0.046]	[0.038]
Management Quality	0.422***	0.318***	0.118*	0.266***	0.401***	0.214*	0.343***	0.243***	0.344***	0.221***	0.145	0.174**
	[0.102]	[0.114]	[0.062]	[0.083]	[0.110]	[0.116]	[0.077]	[0.066]	[0.076]	[0.063]	[0.100]	[0.081]
Capitalisation	-0.091	-0.005	-0.296***	0.085	0.03	0.014	0.022	0.053	-0.102	-0.005	0.113	0.165**
	[0.091]	[0.112]	[0.072]	[0.073]	[0.099]	[0.103]	[0.079]	[0.065]	[0.074]	[0.059]	[0.103]	[0.081]
E-Lerner	-0.060*	0.01	-0.067***	-0.019	0.095***	0.039	-0.095***	0.001	-0.035	0.03	0.016	0.067**
	[0.034]	[0.034]	[0.024]	[0.029]	[0.031]	[0.034]	[0.025]	[0.022]	[0.025]	[0.021]	[0.034]	[0.028]
Constant	0.894***	0.022	0.576***	0.503***	-0.001	0.544***	0.685***	0.374***	0.638***	0.406***	2.026***	1.177***
	[0.102]	[0.144]	[0.085]	[0.087]	[0.125]	[0.130]	[0.084]	[0.070]	[0.082]	[0.067]	[0.130]	[0.108]
Observations	4,881	5,039	5,009	4,881	5,039	5,009	7,901	7,901	8,957	8,957	5,338	5,338
Country-level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.09	1.22	-0.25	0.04	0.18	0.07	0.12	0.04	0.11	0.05	0.24	0.14
F	11.72	56.31	34.3	3.772	12.48	4.34	12.64	5.151	12.54	5.824	20.1	11.5

Table 5.10

Bank level Tobit and Weighted (by bank assets) Tobit regressions for all countries

The dependent variables are bank cost and profit efficiency. All other variables are as described in Table 5.1. Before running Tobit regressions, all variables are averaged over 2004-2012. While the results of bank level Tobit regression are reported in Columns 1-4, the Weighted Tobit are reported in Columns 5-8. The weights are the bank total assets. Heteroskedasticity-robust standard errors clustered for countries are reported in brackets. *, **, *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

VARIABLES	**Bank-level Tobit regression**				**Weighted (by bank assets) Tobit regression**			
	Cost efficiency		Profit efficiency		Cost efficiency		Profit efficiency	
	1	2	3	4	5	6	7	8
Financial Inclusion	0.315**	0.308**	0.084***	0.084***	0.204***	0.185***	0.094***	0.088***
	[0.129]	[0.127]	[0.023]	[0.023]	[0.067]	[0.067]	[0.023]	[0.022]
Bank-specific characteristics								
Loan Ratio	0.021	0.009	0.072***	0.077***	0.067	0.044	0.096***	0.091***
	[0.109]	[0.105]	[0.027]	[0.027]	[0.059]	[0.060]	[0.028]	[0.028]
Bank Size	-0.002	-0.003	-0.003	-0.003	0.011	0.011	0.014***	0.014***
	[0.009]	[0.009]	[0.003]	[0.003]	[0.007]	[0.007]	[0.003]	[0.003]
Loan Loss Provision	0.138	0.134	-0.188*	-0.191*	0.008	0.029	-1.612***	-1.641***
	[0.237]	[0.235]	[0.097]	[0.098]	[0.476]	[0.462]	[0.297]	[0.296]
Income Diversification	0.025	0.022	0.025**	0.026**	0.095*	0.084	0.116***	0.118***
	[0.026]	[0.026]	[0.012]	[0.012]	[0.054]	[0.054]	[0.034]	[0.034]
Management Quality	0.389*	0.377*	0.269***	0.274***	0.597***	0.588***	0.643***	0.633***
	[0.226]	[0.226]	[0.079]	[0.079]	[0.176]	[0.178]	[0.087]	[0.087]
Capitalisation	-0.08	-0.043	0.069	0.06	0.287	0.38	1.060***	1.110***
	[0.148]	[0.166]	[0.058]	[0.059]	[0.242]	[0.246]	[0.133]	[0.133]
C-Lerner	-0.089		0.036*		-0.213***		-0.079***	
	[0.068]		[0.019]		[0.050]		[0.015]	
E-Lerner		-0.098		0.027		-0.256***		-0.111***
		[0.094]		[0.023]		[0.056]		[0.018]
Country Macro-controls								
GDP Growth Rate	-2.131	-2.056	-1.441***	-1.459***	1.156	1.430**	2.437***	2.588***
	[1.333]	[1.353]	[0.271]	[0.273]	[0.710]	[0.702]	[0.238]	[0.240]
Per Capita GDP	-0.047	-0.045	-0.024***	-0.025***	0.011	0.017	-0.008	-0.006
	[0.032]	[0.032]	[0.006]	[0.007]	[0.018]	[0.018]	[0.005]	[0.005]
Constant	0.774**	0.792**	0.493***	0.486***	-0.149	-0.161	-0.320***	-0.319***
	[0.318]	[0.317]	[0.081]	[0.081]	[0.244]	[0.240]	[0.098]	[0.098]
Observations	2,648	2,648	2,648	2,648	2,598	2,598	2,598	2,598
Pseudo R^2	0.59	0.59	9.77	9.59	0.08	0.08	0.06	0.06
Countries	84	84	84	84	84	84	84	84

Table 5.11

Exploiting country and bank unobserved heterogeneity

	Pooled Cross-Sectional Tobit				Random-Effects Panel Tobit			
VARIABLES	**Country x Year Fixed Effects**				**Bank x Year Fixed Effects**			
	Cost efficiency		Profit efficiency		Cost efficiency		Profit efficiency	
	1	2	3	4	5	6	7	8
Financial inclusion	0.054**	0.053**	0.004	0.007	0.103***	0.099***	0.069***	0.065***
	[0.022]	[0.022]	[0.049]	[0.050]	[0.015]	[0.015]	[0.020]	[0.020]
Bank-level controls								
Loan Ratio	0.047***	0.046***	0.024*	0.031**	0.069***	0.070***	0.076***	0.084***
	[0.006]	[0.006]	[0.014]	[0.014]	[0.012]	[0.012]	[0.020]	[0.020]
Bank Size	-0.013***	-0.013***	-0.007***	-0.004***	-0.003	-0.003	0	0.001
	[0.001]	[0.001]	[0.001]	[0.001]	[0.002]	[0.002]	[0.002]	[0.002]
Loan Loss Provision	0.017	0.014	-0.580***	-0.561***	-0.018	-0.024	-0.569***	-0.554***
	[0.027]	[0.027]	[0.059]	[0.060]	[0.026]	[0.026]	[0.068]	[0.068]
Income Diversification	-0.001	-0.001	0.001	0.002	0	0	0.003	0.003
	[0.001]	[0.001]	[0.003]	[0.003]	[0.001]	[0.001]	[0.003]	[0.003]
Management Quality	0.088***	0.088***	0.101***	0.117***	0.017	0.015	0.157***	0.161***
	[0.014]	[0.014]	[0.032]	[0.032]	[0.018]	[0.018]	[0.038]	[0.039]
Capitalisation	-0.114***	-0.095***	0.064**	0.090***	-0.374***	-0.367***	0.117***	0.113**
	[0.014]	[0.015]	[0.031]	[0.032]	[0.024]	[0.025]	[0.044]	[0.045]
C-Lerner	0.003		0.106***		-0.012**		0.061***	
	[0.005]		[0.011]		[0.005]		[0.011]	
E-Lerner		-0.029***		0.024		-0.026***		0.032**
		[0.007]		[0.015]		[0.008]		[0.015]
Constant	0.929***	0.940***	0.535***	0.515***	0.395***	0.399***	0.304***	0.292***
	[0.022]	[0.022]	[0.048]	[0.048]	[0.041]	[0.041]	[0.047]	[0.047]
Observations	14,929	14,929	14,929	14,929	14,929	14,929	14,929	14,929
Country Fixed Effects	Yes	Yes	Yes	Yes	No	No	No	No
Bank Fixed Effects	No	No	No	No	Yes	Yes	Yes	Yes
Country-level controls	No	No	No	No	Yes	Yes	Yes	Yes
Pseudo R^2	5.29	5.30	0.66	0.65	-	-	-	-
Likelihood-ratio test	-	-	-	-	22311***	22323***	2926***	2926***
# of degree of freedom	-	-	-	-	17	17	17	17

Table 5.12

The impact of supportive environment of financial inclusion on the levels of cost and profit efficiency

This table presents difference-in-differences (Panel A) and Matching (Panel B) estimations relating to membership of Alliance for Financial Inclusion (AFI) and bank efficiency. In Panel A, the dependent variables are the *Cost* and *Profit efficiency*. The variable of interest is *Financial Access Policy*, that takes one if a country becomes a member of the AFI network and agrees to share knowledge in order to develop and implement more effective policies designed to expand access to financial services in year *t* and thereafter or else zero. The analogous bank- and country-specific controls are used with a set of year dummies. Heteroskedasticity robust standard errors are reported in brackets. In columns 1-4, the first two columns use country fixed effects, and the last two columns use bank fixed effects. Similarly, the results of the Placebo test are reported in columns 5-8 where we construct an indicator variable assuming that each member country had joined the AFI network three years prior to the actual membership timing. In Panel B, we use three different matching methods include Kernel matching, Stratification matching and the nearest-neighbour bias-corrected matching estimators proposed by Abadie and Imbens (2006). Abadie and Imbens method adjusts the differences within the matches for the differences in covariate values. ATT is the average treatment effect for the treated. The standard errors in Abadie and Imbens are heteroskedasticity-consistent, and *z*-stats are reported. For the rest, we report absolute values of bootstrapped *t*-stats in brackets. The number of observations differs due to the difference in the underlying matching approaches. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively.
Source: BankScope and AFI. Coverage: 2004-2012.

Panel A: Difference-in-differences	Financial Access Policy				Placebo test: Financial Access Policy (-3)			
	Cost efficiency	Profit efficiency	Cost efficiency	Profit efficiency	Cost efficiency	Profit efficiency	Cost efficiency	Profit efficiency
variables	1	2	3	4	5	6	7	8
Financial Access Policy	0.020***	0.021*	0.015***	0.023**	-0.013*	0.009	-0.020***	0.006
	[0.006]	[0.012]	[0.004]	[0.011]	[0.007]	[0.013]	[0.005]	[0.013]
Bank-level controls								
Loan Ratio	0.046***	0.034**	0.070***	0.014	0.047***	0.034**	0.074***	0.017
	[0.008]	[0.014]	[0.015]	[0.038]	[0.008]	[0.014]	[0.015]	[0.038]
Bank Size	-0.013***	-0.004***	-0.005	0.061***	-0.013***	-0.004***	-0.002	0.063***
	[0.001]	[0.002]	[0.006]	[0.012]	[0.001]	[0.002]	[0.006]	[0.012]
Loan Loss Provision	-0.005	-0.483***	-0.054	-0.547***	-0.006	-0.483***	-0.053	-0.547***
	[0.051]	[0.111]	[0.061]	[0.167]	[0.051]	[0.111]	[0.061]	[0.167]
Income Diversification	-0.001	0.002	0.001	0.002	-0.001	0.002	0.001	0.002
	[0.001]	[0.005]	[0.001]	[0.005]	[0.001]	[0.004]	[0.001]	[0.005]
Management Quality	0.072***	0.086***	-0.054**	-0.015	0.072***	0.087***	-0.056**	-0.013
	[0.020]	[0.031]	[0.024]	[0.051]	[0.020]	[0.031]	[0.024]	[0.051]
Capitalisation	-0.108***	0.087**	-0.433***	0.264***	-0.109***	0.086**	-0.427***	0.268***
	[0.028]	[0.036]	[0.045]	[0.087]	[0.028]	[0.036]	[0.045]	[0.087]
E-Lerner	-0.034***	0.014	-0.027***	0.042*	-0.034***	0.014	-0.027***	0.042*
	[0.009]	[0.015]	[0.009]	[0.023]	[0.009]	[0.015]	[0.009]	[0.023]
Country Macro-controls								
GDP Growth Rate	0.172***	0.307***	0.218***	0.390***	0.171***	0.297***	0.221***	0.381***
	[0.036]	[0.099]	[0.029]	[0.099]	[0.036]	[0.100]	[0.029]	[0.099]
Per Capita GDP	0.110***	-0.002	0.095***	-0.157***	0.149***	0.02	0.129***	-0.134***
	[0.022]	[0.042]	[0.018]	[0.046]	[0.022]	[0.041]	[0.018]	[0.045]
Constant	-0.268	0.477	-0.047	1.550***	-0.636***	0.275	-0.390**	1.318***
	[0.210]	[0.400]	[0.159]	[0.422]	[0.208]	[0.387]	[0.159]	[0.408]
Observations	15,509	15,509	15,509	15,509	15,509	15,509	15,509	15,509
Country Fixed Effects	Yes	Yes	No	No	Yes	Yes	No	No
Bank Fixed Effects	No	No	Yes	Yes	No	No	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.82	0.29	0.91	0.39	0.82	0.29	0.91	0.39

Panel B: Matching estimators	Cost efficiency			Profit efficiency		
Variables	Kernel	Stratification	Abadie-Imbens	Kernel	Stratification	Abadie-Imbens
	1	2	3	4	5	6
ATT	0.064***	0.056***	0.049**	0.055***	0.051***	0.022
S.E.	[0.011]	[0.011]	[0.019]	[0.013]	[0.012]	[0.039]
t-stat	[5.674]	[5.179]	[2.510]	[4.354]	[4.371]	[0.560]
Observations	17291	17291	17159	17291	17291	17159
Common support condition	Yes	Yes	Yes	Yes	Yes	Yes

Note: Financial Inclusion variable has some missing observations. As we do not use this variable in the DID and Matching estimators the total number of observations has increased compared to earlier regressions in this paper.

Appendix 5.A

Table 5.A1

Correlation Matrixes

This tables presents correlation between key variables used in this study. Variable definitions are provided in Table 5.1.

Bank-level variables		1	2	3	4	5	6	7	8		
1	C-Lerner	1									
2	E-Lerner	0.67***	1								
3	Loan ratio	0.11***	0.02*	1							
4	Total assets	0.02**	-0.11***	0.02*	1						
5	LLP ratio	0.01	0.02*	-0.06***	-0.04***	1					
6	Income diversification	0.04***	0.06***	-0.05***	-0.01	0.03***	1				
7	Management quality	-0.05***	-0.19***	0.22***	0.12***	-0.15***	-0.08***	1			
8	Equity ratio	0.06***	0.27***	-0.07***	-0.39***	0.11***	0.07***	-0.29***	1		

Country-level variables		1	2	3	4	5	6	7	8	9	10
1	Financial inclusion	1									
2	GDP growth rate	-0.44***	1								
3	log GDP per capita	0.69***	-0.52***	1							
4	Voice and accountability	0.58***	-0.42***	0.78***	1						
5	Political stability	0.56***	-0.37***	0.79***	0.75***	1					
6	Government effectiveness	0.66***	-0.34***	0.80***	0.79***	0.79***	1				
7	Regulatory quality	0.60***	-0.42***	0.86***	0.86***	0.80***	0.91***	1			
8	Rule of law	0.63***	-0.35***	0.81***	0.84***	0.81***	0.97***	0.94***	1		
9	Control of corruption	0.61***	-0.30***	0.79***	0.78***	0.80***	0.97***	0.89***	0.97***	1	
10	Institutional quality index	0.65***	-0.39***	0.86***	0.89***	0.88***	0.97***	0.96***	0.98***	0.96***	1

Appendix 5.B

Table 5.B1

First-Stage Regression Results

This table reports the first-stage regression results of the IV Tobit estimation for the period 2004-2012. The dependent variable is the financial inclusion index. Variable definitions are provided in Table 5.1. Heteroskedasticity-robust standard errors are presented in brackets. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

VARIABLES	1	2	3	4	5	6
Instrumental variables						
Remittance flow to GDP	-0.195***	-0.214***	-0.187***	-0.217***		
	[0.042]	[0.043]	[0.037]	[0.039]		
Government bank ownership	-0.000***	-0.000***				
	[0.000]	[0.000]				
Monetary freedom			0.015***	0.014***		
			[0.000]	[0.000]		
New firm entry density					-0.006***	-0.006***
					[0.000]	[0.000]
# of banks					0.000***	0.000***
					[0.000]	[0.000]
Bank-level controls						
Loan Ratio	-0.030**	-0.032***	-0.090***	-0.096***	-0.160***	-0.169***
	[0.012]	[0.011]	[0.009]	[0.009]	[0.010]	[0.010]
Bank Size	0.013***	0.013***	0.013***	0.012***	0.016***	0.014***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Loan Loss Provision	-0.026	-0.037	-0.036	-0.064	-0.019	-0.055
	[0.058]	[0.064]	[0.057]	[0.070]	[0.052]	[0.068]
Income Diversification	-0.105***	-0.101***	-0.011	-0.011	-0.01	-0.009
	[0.032]	[0.030]	[0.010]	[0.009]	[0.009]	[0.009]
Management Quality	0.164***	0.154***	0.167***	0.138***	0.128***	0.118***
	[0.026]	[0.025]	[0.020]	[0.020]	[0.020]	[0.020]
Capitalisation	0.008	0.033	-0.142***	-0.065***	-0.190***	-0.103***
	[0.021]	[0.021]	[0.021]	[0.022]	[0.023]	[0.024]
C-Lerner (-1)	-0.030***		-0.088***		-0.137***	
	[0.008]		[0.007]		[0.007]	
E-Lerner (-1)		-0.069***		-0.168***		-0.205***
		[0.010]		[0.009]		[0.009]
Country-level controls						
GDP Growth Rate	-0.719***	-0.688***	-0.598***	-0.549***	-0.095**	-0.091**
	[0.044]	[0.044]	[0.042]	[0.041]	[0.047]	[0.046]
Per Capita GDP	0.096***	0.096***	0.067***	0.067***	0.080***	0.082***
	[0.001]	[0.001]	[0.002]	[0.002]	[0.002]	[0.002]
Constant	-0.585***	-0.568***	-1.425***	-1.333***	-0.386***	-0.361***
	[0.031]	[0.030]	[0.025]	[0.026]	[0.024]	[0.024]
Observations	11,165	11,165	14,575	14,575	12,869	12,869
F	1192	1165	2693	2827	2098	2144
Adjusted R-squared	0.47	0.48	0.64	0.65	0.56	0.57

Table 5.B2

Interactive result of financial inclusion with bank competition and institutional quality using IV Tobit regressions

We use IV Tobit regressions to estimate the interactive effects of financial inclusion with bank competition and institutional quality. The only addition in this model is the interaction term and its constituents. All regressions include year fixed effects. *Financial Inclusion* and *Financial Inclusion times E-Lerner* are treated as endogenous variables, and they are instrumented via the instruments listed at the bottom of the table. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Source: BankScope and WDI. Coverage: 2004-2012.

VARIABLES	Cost efficiency	Profit efficiency	Cost efficiency	Profit efficiency
	1	2	3	4
Financial inclusion	3.568***	2.450***	3.935***	2.407***
	[0.589]	[0.682]	[0.436]	[0.252]
E-Lerner	2.360***	-0.804*	0.105***	0.136***
	[0.782]	[0.438]	[0.037]	[0.025]
Financial inclusion x E-Lerner	-3.189***	1.206**		
	[1.054]	[0.605]		
Institutional quality index			-0.153***	-0.048*
			[0.046]	[0.026]
Financial inclusion x Institutional quality index			0.469***	0.182***
			[0.095]	[0.055]
Bank-level controls				
Loan Ratio	0.111	-0.061	0.024	0.058**
	[0.090]	[0.060]	[0.045]	[0.030]
Bank Size	-0.084***	-0.006	-0.049***	-0.024***
	[0.015]	[0.005]	[0.007]	[0.004]
Loan Loss Provision	-0.248	-0.540***	0.147	-0.528***
	[0.272]	[0.155]	[0.182]	[0.123]
Income Diversification	0.331***	0.174***	0.241***	0.180***
	[0.064]	[0.042]	[0.045]	[0.028]
Management Quality	-0.665**	0.251**	0.224*	0.065
	[0.276]	[0.103]	[0.115]	[0.072]
Capitalisation	-1.137***	-0.02	-0.609***	-0.233***
	[0.233]	[0.102]	[0.104]	[0.069]
Country Macro-controls				
GDP Growth Rate	1.273	1.814*	1.226**	0.846**
	[0.912]	[1.026]	[0.608]	[0.368]
Per Capita GDP	-0.249***	-0.208***	-0.381***	-0.235***
	[0.051]	[0.058]	[0.044]	[0.025]
Constant	2.246***	1.037***	2.289***	1.521***
	[0.285]	[0.185]	[0.319]	[0.180]
Observations	9,596	9,652	9,596	9,652
chi2	131.1	128.1	361.4	288.1
Wald Chi2 statistics: exogeneity	1027	84.49	1623	297.4
p-value of exogeneity	0.00	0.00	0.00	0.00
Under-identification test (p-value)	0.00	0.00	0.00	0.00
Over-identification test (p-value)	0.09	0.13	0.07	0.11
IV instruments				
Remittance	√		√	
Government bank ownership	√	√	√	√
Monetary freedom		√		
Entry density	√	√	√	√
# of banks				√

Appendix 5.C

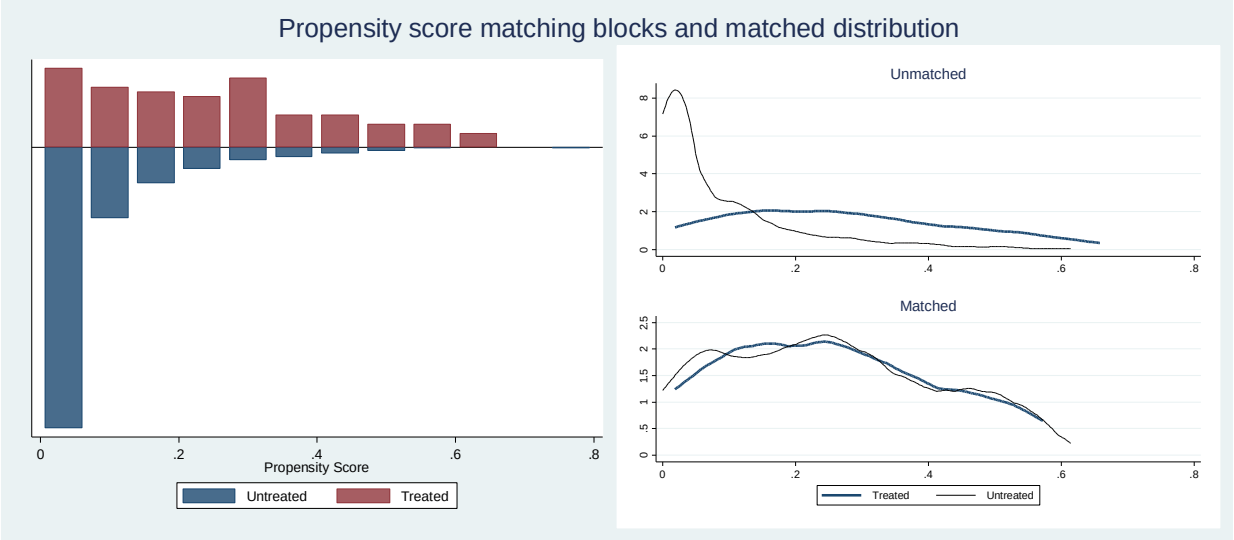
Table 5.C1

The propensity score matching analysis–Logit model and balancing tests

Logit model: dependent variable = Financial Access Policy			Balancing tests			
Variables	**coefficients**	**z-statistics**	**Full sample**	**Block 1**	**Block 2**	**Block 3**
Log of total assets of the financial system	0.879***	[5.500]	0.94	0.13	0.14	0.4
Log of per capita GDP	-1.260***	[-5.432]	0.72	0.1	0.07	0.78
GDP growth rate	4.614	[1.277]	0.69	0.9	0.39	0.41
Financial freedom	0.005	[0.307]	0.89	0.46	0.11	0.47
Regulatory Quality	1.737***	[2.729]	0.84	0.25	0.15	0.31
Rule of Law	-1.012	[-1.591]	0.9	0.29	0.72	0.05
Control of Corruption	-0.504	[-0.837]	0.8	0.33	0.52	0.14
Constant	1.026	[0.628]				
Observations	433					
Chi-squared	55.51***					
Pseudo R-squared	0.149					
Hosmer–Lemeshow test (p-value)	0.12					
Standard deviation of the propensity score	0.14					

Note: The dependent variable, *Financial Access Policy* takes the value of 1 for a country that participates in the AFI network in year 2009 and thereafter, or else zero. The detailed description of the independent variables is given in Table 5.1. *Z-statistics* are reported in brackets. The Hosmer–Lemeshow test confirms the goodness-of fit of the logit model. Regarding balancing tests, we conduct t-tests of each independent variable used in the logit model. P-values are reported where the first column shows the balancing tests of the entire sample. The observations have been divided into four blocks (or strata), of which Stata does not report any t-tests for the fourth block as it has only 5 observations. Based on p-values, we cannot reject the null hypothesis that each characteristic is equal across the control and treatment groups in the full sample or in each block.

Figure 5.C1
Propensity score matching blocks and matched distribution



Note that while the left figure shows common support between the treated (member of AFI network) and untreated/comparison groups (non-member), the right figure shows the distribution of the unmatched and matched sample.

Chapter VI

Conclusions

6.1 Overview

In this thesis, we study bank competition and financial inclusion, analysing their impact on bank performance–profitability, stability and efficiency. Analysing the consequences of the changes of banking market structure and the degree of financial inclusion is important, as the banking systems around the world–especially emerging market economies–have gone through numerous important reforms and structural changes. The outcome of the changes is a strong competitive environment, where banks of heterogeneous sizes and ownership types compete fiercely for market shares. Currently, they are more inclined to broaden the access of unbanked people to financial services and diversify business towards areas that used to be excluded or underserved–partially due to enabling an inclusive financial environment. This chapter provides overall concluding remarks for each of the four essays in this thesis. It highlights the core contributions of each essay to the current literature. It also acknowledges the limitations that are associated with selected techniques and methodologies, provides public policy implications of this research and finally unearths some areas for further research.

Chapter II is the first essay in this thesis and investigated the effects of bank credit risk and income diversification on profitability of the Indian banking industry using bank-level data of the post-reform period 2004-2011. Despite multiple reforms, the Indian

banking sector still remains dominated by big and government-owned banks. Limited empirical research on such issues also necessitates this study to examine the role of heterogeneous bank size and mixed ownership groups on the effects of credit risk and income diversification. The empirical results that we have found in this chapter are in line with the results of developed market economies, that large banks dominate the entire banking industry. The result shows that credit risk has a negative impact on profitability which is pronounced for the foreign-owned banks. The dampening effects of nonperforming loans diminish as banks gets bigger. Again, as bank size gets bigger, the positive effect of non-interest income also increases.

Chapter III built upon the findings of chapter II and delved deep into the most perennial problem of the Indian banking sector–nonperforming loans. Over the last two decades, the Indian government has introduced various laws and institutional mechanisms to curb credit risk. In 2002, RBI introduced an institutional mechanism–Corporate Debt Restructuring (CDR) – to minimise a bank's exposure to sick corporates. The aim of CDR has been to provide a speedy, cost effective, and market friendly alternative to in-court restructuring procedures for banks to undertake restructuring of corporate loans, and subsequently reduce credit risk. By restructuring corporate loans, banks that were members of the CDR system could retain asset classification of those loans, and even upgrade nonperforming restructured assets to standard (performing) category after a specified period and charge less to their net income for loan loss provisions. This special regulatory forbearance on asset classification and provisioning gave more opportunities to member banks to understate nonperforming loans and overstate net income. Therefore, in this chapter, we have contributed to the literature on debt restructuring from the creditor's perspective by investigating the impact of the CDR system on bank stability. We have exploited the membership variation of banks of the CDR programme and empirically examined the treatment effects of CDR on bank-level stability using the 'natural

experiment' type difference-in-differences (DID) approach. Sample selection bias is eliminated by using a number of matching estimators including the recently developed bias-corrected covariate matching estimator. Both DID and matching estimators suggest that after the genesis of CDR, member banks with generous regulatory forbearance on asset classification and provisioning experience an improvement in stability. We also show that the positive impact of CDR diminishes as the market power of member banks increases. Given the scarcity of research on the Indian banking sector, we have also looked at the ambiguous issue of whether greater competition is good or bad for banking stability, and contributed to the current literature by providing evidence from an emerging market economy that greater bank competition induces excessive risk-taking of individual banks, supporting the competition-fragility hypothesis.

Chapter IV moved away from single-country to cross-country analysis. It took a unique approach and used large cross-country data from a number of sources, and investigated the effects of the most contemporary global policy issue–financial inclusion–on bank level stability. Broadening access of the low income groups to formal financial services is the most challenging issue for banks as serving poor customers is costly and risky. Therefore, extending the access of the poor people to finance has always been perceived as an antagonistic strategy by banks that might dampen their performance. Despite financial inclusion being the crucial component to financial development strategies and inclusive economic growth, empirical study on this important public policy issue is non-existent. The obvious reason for limited research in this area is due to supply- and demand-side data constraints on access. Another important reason is the lack of development of a reliable quantitative index of financial inclusion. In this chapter, we have made several contributions to the literature. First, using a unique dataset–Financial Access Survey (FAS)–we have constructed a multidimensional index of financial inclusion for 87 countries for the period 2004-2012, and then investigated a new research question–for the

first time–as to whether the global policy drive towards greater financial inclusion is good for bank stability in a sample of 2,913 banks. Second, we have also contributed to the literature that explores the determinants of banking stability. Finally, by exploiting the exogenous variation in the membership timing of developing countries' network of financial inclusion policymakers, we have explored whether enabling the inclusive financial environment has any causal effect on banking stability, using parametric (difference-in-differences) and non-parametric matching estimators. The results show that a more inclusive financial sector leads to greater bank stability, and this nexus is reinforced while banks have higher market power and operate in the countries where institutional qualities are greater, providing novel insights for regulatory authorities, banking supervisors and market participants.

Chapter V extended the analysis of chapter IV, and dug deep into another important aspect of bank performance. Banks typically "shy away" from extending credits to poor customers due to high operating costs associated with them assuming that serving low creditworthy customers might dampen their efficient financial intermediation. Therefore, in this paper, we have contributed to the existing empirical analyses in numerous ways. First, we fill an important gap in the literature by providing new evidence on the impact of financial inclusion on bank efficiency, and seeing the role of bank competition and institutional quality on this relation using an international sample of 2913 banks across 87 countries for the period 2004-2012. Second, as well-functioning and efficient financial systems exert a first-order impact on economic growth (see e.g., Levine, 2005), we have also contributed to the literature on finance and growth by exploring the connection between important aspects of financial development and the efficiency of financial institutions. Third, exploring the determinants of bank efficiency is also an important contribution to the banking literature. Finally, by exploiting cross-country and cross-year variation in the timing of countries into a global network of financial inclusion

policymakers, we have also contributed to the literature showing how enabling an inclusive financial environment affects bank efficiency. The results indicate that the higher the degree of financial inclusion, the better the banks' performance in terms of increasing cost and profit efficiency. To address potential omitted variable biases and reverse causality, which might bias the empirical results, we have confirmed our findings using an instrumental variable approach. Further evidence shows that the efficiency enhancing effects of financial inclusion are stronger when banks have lower competition and operate in countries with stronger rule of law and institutional quality. We have shown that enabling an inclusive environment has a positive impact on bank efficiency.

6.2 Summary and public policy implications

This thesis bundles four essays and makes several contributions to the most contemporary global policy issue related to market structure, bank performance, financial development and financial inclusion. The results of this thesis give rise to several important public policy considerations.

First, chapter II uncovered the strong influence of bank size/ownership structure on the relationship between credit risk/income diversification and bank profitability. These results emphasise the importance of taking bank size and ownership heterogeneities into consideration while formulating policies in order to augment profitability in the banking sector. Bank managers can reap the diversification benefit if they pursue cautiously by considering their sizes, strengths, capabilities and risk level, and embarking on the areas they are good at. Second, by exploiting membership variation of the banks that have undertaken restructuring of corporate loans and making use of extensive regulatory forbearance on asset classification and provisioning, chapter III showed the robust treatment effect of the corporate debt restructuring (CDR) programme on banking stability. However, the finding of the interactive effect is alarming for the regulator as the marginal

effect of CDR on soundness of banks is statistically different from zero before a threshold level of efficiency-adjusted Lerner Index of around 38 points. Although improving soundness of banks was largely achieved by exploiting the CDR programme, the recent up-trend in restructuring of corporate loans is worrying. Therefore, regulators should tighten the macroprudential norms and emphasise international best practice in asset classification and provisioning of restructured corporate loans ensuring no scope for ever-greening (Peek and Rosengren, 1995). Since it is predicted that at least 20-30% of restructured standard corporate loans will slip into sub-standard loans eventually (WG, 2012), banks should increase provisioning on existing restructured loans gradually, otherwise any substantial losses might lead them to exhaust capital base at a point where insolvency or illiquidity would be inevitable.

Third, our study on the effects of an inclusive banking sector on banking stability has substantial public policy implications. The outcome of chapter IV suggests that banking stability is strongly influenced by the degree to which the poorest of the poor individuals and small enterprises have access to basic financial services, which indicates the importance of ensuring an inclusive financial system. An inclusive financial system will allow banks to exploit the untapped potential of customers who were previously unbanked or under-banked, and strengthen their balance sheets making them more resilient against a possible future shock. Since expanding access to financial services is a key ingredient of a financial development strategy, the concerted and sustained efforts of formal financial institutions to allocate resources in more productive areas of the economy would make them more profitable. As only 41% of people in the developing countries compared to 89% in developed ones have bank accounts (see Demirgüç-Kunt and Klapper, 2012), additional policies should focus on ensuring access of all those excluded to formal financial services, especially in the developing economies. Furthermore, our results also stress the importance of the underlying competitive and institutional framework. The

beneficial effects of financial inclusion on bank stability are greater in the countries where the market power of banks and institutional qualities are high. In this respect, since competition is perceived to be instrumental to broadening access to finance but detrimental to banking stability, broadening access without paying attention to potential negative consequences of competition on financial stability is obviously suboptimal. Therefore, it is important for the authorities to strike the right balance between financial inclusion and bank competition while avoiding stepping into financial fragility. They should also continue the efforts of establishing an institutional environment that will complement the access-stability nexus.

Finally, the results of Chapter V suggest that the greater the banking population the higher the bank efficiency, both in terms of cost and profit. Therefore, policymakers should introduce more policies that are conducive for access to finance aiming at ensuring efficient financial intermediation. Furthermore, our results also stress the importance of the underlying competitive and institutional framework. The beneficial effects of financial inclusion on bank cost (profit) efficiency are more (less) in the countries where bank competition is high (low). In this respect, regulators should pay adequate attention to balancing this moderating effect of bank competition on the nexus between financial inclusion and cost/profit efficiency. They should continuously make efforts to provide an environment that would be conducive for increasing financial inclusion and hence bank efficiency. The overall findings of this thesis on such an important contemporary policy issue would be useful to researchers and policymakers alike for making informed decisions on access policies knowing the likely effect of those decisions on the soundness and efficient functioning of financial institutions. The policy areas that we have identified in this thesis would be critical for policymakers to spur inclusive economic growth as banking stability and efficiency gains would certainly increase the availability of more productive loans and overall economic development.

6.3 Limitations of the thesis

Though this thesis has employed a number of techniques and methodologies to offer robust results that should have a wide range of implications for policymakers, regulators, bank managers and the general public, it is not without some limitations. First, despite using two variant measures of Lerner indices–conventional Lerner and efficiency-adjusted Lerner–that provide relatively close estimates of banking competition, the most important challenge in this measure is the difficulty in gathering data on prices and marginal cost. However, using two variant measures of Lerner indices in this thesis serves as a good indicator of the level of bank competition, making the ensuing analysis related to competition more robust. Second, in chapters IV and V, though we tried to add as many dimensions as possible to get a comprehensive picture of the overall financial inclusion of a country, we acknowledge that there must be other factors contributing to financial inclusion. However, the robustness of our index of financial inclusion has been checked using both household-based indicators of financial inclusion and firm-level data from World Bank Enterprise Surveys. Finally, despite our best effort to address the endogeneity concern in each line of research in this thesis, it is possible that the results of chapter II may be biased because of the endogeneity problem between income diversification and bank profitability. Endogeneity can arise if banks engage more in non-interest income activities because of higher profitability. However, we have got relatively good results with satisfactory diagnostic statistics by using static panel estimators, where using instrumental variable techniques would have reduced the total number of observations and resulted in loss of degrees of freedom due to one or two period lagged values. The core findings of this chapter remain unaltered even after conducting an array of robustness tests.

6.4 Avenues for future research

This thesis has undertaken comprehensive analyses on numerous contemporary issues of bank performance and financial development. Since this thesis contains essays from an emerging market economy–India– and constitutes the first attempt to explain statistically how an inclusive financial sector affects bank performance, it has unravelled a number of key questions and developed promising avenues for future research as follows:

First, considering the recent development in the measurement of bank competition, future research can focus on the Boone indicator method (Boone, 2008)–a measure of bank competition–to see the link between bank completion and stability for Indian banks. The Boone indicator considers that competition improves the performance of efficient banks and weakens the performance of inefficient ones. Given the market and regulatory environment, this indicator is better suited to measure competition for Indian banks and for use in subsequent analysis.

Second, we need more empirical evidence on the impact of financial inclusion on bank performance that would be useful to policymakers for making informed decisions on such an important development issue. Third, as more data–both supply and demand-side–become available, as many dimensions as possible should be incorporated in the construction of the financial inclusion index for more reliable subsequent analysis. Finally, since developing countries are gradually introducing supportive new laws and regulation to enhance inclusive financial activity, a fourth component of the research agenda concerns the effect of these legal changes on the lending behaviour of banks in developing countries.

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